

Northern Region Sustainable Water Strategy



Our Water Our Future



Volumes of water

Different volumes of water are referred to in this document.
Volumes of water are measured in litres.

One litre	1 litre	1 litre	1 L
One thousand litres	1,000 litres	1 kilolitre	1 KL
One million litres	1,000,000 litres	1 megalitre	1 ML
One billion litres	1,000,000,000 litres	1 gigalitre	1 GL

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The Government of Victoria proudly acknowledges and pays its respects to Victoria's Native Title Holders and Traditional Owners and the rich culture and intrinsic connection they have to Country. The Government also recognises and acknowledges the contribution and interest of other Indigenous people and organisations in catchment and water management. The Government acknowledges that the past injustices and continuing inequalities experienced by Indigenous people have limited, and continue to limit, their proper participation in catchment and water management.

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Part One - Background

This section describes the role of the Northern Region Sustainable Water Strategy and how it was developed. It outlines the key threats to water resources, and assesses the likely impact of these threats on water users and the environment.

Part Two - Region-wide actions

This section outlines the actions that apply generally to all entitlement-holders across the region. It focuses on protecting Victoria's secure water entitlements and providing certainty and flexibility to manage through droughts and climate change.

Part Three - Tailored actions

This section outlines the actions that aim to meet the specific water needs of each major sector: irrigation; environment; urban; and the broader community.

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Minister's foreword



In the face of unprecedented drought, northern Victoria's farmers, businesses, water managers and communities are rapidly changing the way they use water.

With the prospect of lower and less reliable rainfall continuing in a climate change future, the Northern Region Sustainable Water Strategy identifies important actions that will assist the region to successfully adapt to changing conditions.

In concert with the Victorian Government's investment in major infrastructure projects, the Strategy provides certainty about water rights by protecting the integrity of entitlements for farmers, towns and rivers.

It also recognises the importance of ensuring water can be delivered when and where it is needed. And it provides increased flexibility in managing water sustainably to meet urban, agricultural and environmental needs.

This Strategy is a benchmark document that:

- Sets out the challenges facing all water users, and integrated actions to meet these challenges.
- Provides an innovative approach to climate change adaptation in water planning.
- Provides a new framework for adaptive decision making for managing our environmental assets.
- Sets out arrangements to integrate water planning across the boundaries of local councils, water corporations and catchment management authorities.
- Provides a framework to assist in developing the Murray-Darling Basin Plan.

My thanks to the community and representatives of the Consultative Committee and working groups who participated in developing the Strategy.

The Northern Region Sustainable Water Strategy is the culmination of 18 months' hard work – but in many ways, it is only the beginning as we now work together to implement the Strategy's actions.

A handwritten signature in black ink, appearing to read 'Tim Holding'.

Tim Holding MP
Minister for Water

Consultative Committee Chair's foreword



It has been my pleasure to chair the Consultative Committee responsible for guiding the development of the Northern Region Sustainable Water Strategy. The challenge has been to guide the production of a robust and achievable water strategy that is fair for all users across the Northern Region. Thanks to the many groups and individuals who have involved themselves in the Strategy development process and taken opportunities to influence the substance of the Strategy - I believe that this challenge has been met.

The members of the Consultative Committee have committed much of their time and energy over an 18-month period. They have provided a diversity of perspectives and experiences, weighed up the information available and contributed willingly to the consideration of a wide variety of policy options and proposals.

Underpinning the functioning of the Consultative Committee has been four working groups that provided more detailed analysis and helped develop options into practical proposals. The allocation and environment working groups, chaired by John Dainton, were particularly indispensable in forming some of the more challenging policy proposals. Members of these groups included officers of regional water corporations and catchment management authorities, irrigators from different districts, representatives of peak irrigation and environment sectors, a member of a local environment group and regional officers of State Government departments.

The Strategy development process provided open opportunity for public submissions and community comment in response to a Discussion Paper and a Draft Strategy which included a broad range of proposals. The process was well led by a competent departmental team and was very effective in attracting valuable community input which has clearly influenced the final Strategy. The Strategy team's facilitation and support was much appreciated by the Consultative Committee and the working groups.

Members of the working groups and of the Consultative Committee had to get their minds around a range of perspectives and ideas and many tough issues, sometimes with only less than attractive solutions being available. I applaud the commitment and persistence of these members in shaping the actions in the final Strategy. Their deliberations have clearly helped make sure the final Strategy is robust, achievable and fair.

While the future is largely uncertain, there are some things we can be clear about – Victoria's Northern Region can continue to be Australia's food bowl with efficient and sustainable irrigated agriculture, manufacturing and service industries; diverse river, wetland and floodplain ecosystems; home to dynamic, prosperous and resilient communities; and a place where people want to live, work and visit. This Strategy, with its risk identification and adaptive management approach, including for river and wetland health, as well as its focus on actions to allow individual water users to manage their own supply risk, will be an important platform for maintaining this position for northern Victoria.

A handwritten signature in black ink that reads "Denis Flett". The signature is fluid and cursive, with the first name "Denis" and last name "Flett" clearly distinguishable.

Denis Flett
Chair, Consultative Committee

Executive summary

This Northern Region Sustainable Water Strategy discusses threats to water availability and quality over the next 50 years, and outlines actions to manage the consequences of prolonged drought and climate change.

Thriving regional communities make an important contribution to the economic development and prosperity of all Victorians. The Strategy will support: communities that value and care for the environment in which they live; prosperous communities that use their water resources for high-value activities that create jobs and wealth; and resilient communities that are able to adapt to changing water availability.

The changing landscape in northern Victoria

Social and economic restructuring has been a feature of agriculture and regional communities in Australia since white settlement. The environment has been modified to provide water for towns and industries and the health of rivers and wetlands degraded. The distinguishing features of the current changes in northern Victoria are their magnitude and speed.

In some instances, historical legacies of closer settlement are being swept aside, especially in the north-west. The changes are producing significant consolidation and movement; people are moving away; farms are getting larger; and some dairy farmers, for example, are moving south where they can rely on rainfall.

Twelve years of drought, including record low streamflows and inflows in 2006, have also changed the northern Victorian landscape, possibly forever. While the effects are not uniform across the towns and the industries of the Northern Region, the drought and reduced water availability have exposed many underlying stresses in communities, industries and the natural assets of the region.

Features of the Northern Region

The Northern Region includes Victoria's share of the River Murray, and its Victorian tributaries – the Kiewa, Ovens, Broken, Goulburn, Campaspe and Loddon River systems. Its current population of 529,000 is projected to increase to 781,000 within 50 years.

This is Victoria's 'food bowl', contributing significantly to the nation's prosperity through the production of food and fibre. The region's agricultural industry contributes about \$3.26 billion a year to the Victorian economy. The area supports both dryland and irrigation farming; it is a vast patchwork of grains, livestock, dairy, horticulture and wine grape enterprises ranging from small four-hectare properties to broadacre farms. Its communities, large and small, have existed for generations, expanding with opportunities and contracting in the hard times.

The region has a vital network of rivers, wetlands and floodplains providing homes for ancient river red gums and a diversity of other plants and animals, amenity and pleasure for residents and visitors and business opportunities from tourism.

It is evident that primary producers and communities are increasingly aware that some of the drivers of change in the region include water availability, weather variability and the likely impact of a changing climate; already they are dealing with the consequences.

There has been a noticeable shift in attitudes to water and water markets. Farming is an increasingly sophisticated business and water management practices that were not widely used 10 years ago, such as trading to manage water scarcity, are now common-place.

The region's communities and primary producers have a culture of strong leadership, actively engaging in debate about critical issues such as water management, and helping shape government decisions. Regional innovations in water management are now applied in other irrigation areas in Victoria and interstate.

Winter - Spring 2009

From Corryong in the north-east to Merbein in the north-west, resilient communities are battling to survive after 12 years of drought; with no end in sight, spirits are understandably depressed.

The impact of the drought on the Northern Region's natural assets, including its vast network of national parks, rivers, wetlands and floodplains, is also increasingly evident. Thousands of hectares of river red gums along the southern banks of the River Murray are dead or dying. Key wetlands are dry and significant bird breeding events are less frequent. Some of the state's most valuable natural assets and species are only kept alive through a system of drought refuges being given just the right amount of water at critical times to maintain them.

Although the current drought began in 1997, reserves in the main water storages in the Goulburn system protected the region from the worst impacts until 2002 and the reserves on the Murray lasted until 2006. Low water allocations, therefore, are a relatively new feature of life in the towns and communities relying on the River Murray, and irrigators are still adjusting to this new reality.

Irrigated industries are under pressure due to reduced water availability, falling commodity prices and difficult access to finance. Some farmers are selling their water entitlements and leaving the land, while others are reducing debt or downsizing. In the Sunraysia area for example, up to 30 per cent of farming property, mostly small-holdings, is out of production with irrigation turned off.*

At the same time, an ambitious distribution system modernisation program is underway in the Goulburn-Murray Irrigation District and another is planned for Sunraysia. Already some irrigators are enjoying the benefits of an upgraded system, including more efficient water delivery and improved service levels. This display of confidence in the future, albeit a future with less water, is contributing to greater optimism throughout the region.

Certainty and flexibility in a future of less water

There is not enough water to meet all of the Northern Region's needs as they exist today. But how much does the region need, where will it come from and how will we share it? How will we deal with less?

Governments cannot guarantee water availability, but they can, and must, provide the policy and institutional frameworks, rules, tools and information to help people make the best decisions for themselves, their towns, their businesses and the environment.

An underlying theme of the Strategy is that certainty and flexibility are vital for healthy communities, business and the environment in the region.

The Strategy will protect key agricultural, environmental and urban values through actions that:

- recognise and protect existing entitlements to provide greater investment certainty
- enhance markets, carryover and reserve policies to increase the ability of entitlement-holders to manage the risks caused by variability of water supplies
- use water available for consumption and the environment more efficiently to get greater benefits from less volume
- deliver multiple benefits from public investment in irrigation modernisation, on-farm programs, river and wetland health programs and environmental water purchase programs.

* SunRISE 21 Inc (2009) 2008-09 Drought Impact: Irrigation Status Report for the Sunraysia Pumped Irrigation Districts. Final Report, Mallee Catchment Management Authority, Mildura

The Northern Region Sustainable Water Strategy (see Chapter 1)

The Strategy is a major part of the Northern Region's response to future droughts and the uncertainty of climate change.

Science and recent experience are telling us there is likely to be less water available during the next 50 years than in the past 100 years because of climate change and variability. Chapter 1 describes the purpose of regional sustainable water strategies, the features of the Northern Region, the guiding principles of this Strategy, the process used to develop it and the way it will be implemented.

How much water will there be in the future? (see Chapter 2)

Climate change and variability are the biggest threats to water availability in the Northern Region.

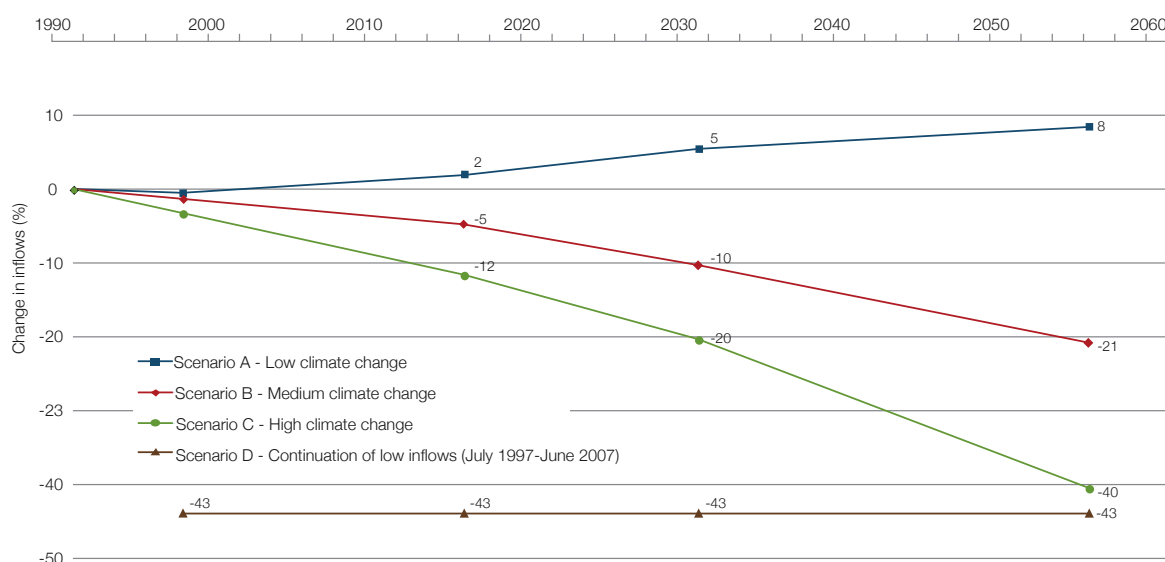
It is impossible to know how much water will be available in the future and to manage this uncertainty, the Strategy's policies and actions aim to be effective under a range of conditions. They make use of the CSIRO's low, medium and high climate change scenarios, and a more severe scenario based on a continuation of the extreme conditions experienced since July 1997. These four scenarios are compared to long-term averages. As an example, Figure E.1 illustrates future water availability in the Murray system under each scenario.

The most severe climate change scenario spells significant adjustment for the environment, as it does for the irrigation sector and the communities that depend on it. The western catchments such as the Campaspe and Loddon are likely to be harder hit than eastern ones such as the Kiewa and Ovens.

There is a risk of insufficient water in some years to run the channel system and deliver water to irrigators and domestic and stock customers. More restrictions on the use of groundwater and more frequent, extended and severe water restrictions in urban areas can be expected.

With climate change, there is a disproportionate impact on the environment because most environmental water comes from unregulated flows that spill from reservoirs or otherwise cannot be harvested.

Figure E.1 Forecast availability of total inflows for the Murray system* to 2055 (Scenarios A to D compared with the long-term average)



Note: * Refers to total Murray system, not just Victoria's share.

Sharing water resources in the Murray-Darling Basin (see Chapter 3)

Recognition of community adjustment issues, the need for strong community engagement and protecting the rights of entitlement-holders are critical for successful management of the Murray-Darling Basin's water resources.



The Commonwealth Government now has more powers and a greater role to play in Murray-Darling Basin water management.

The Commonwealth can reduce the water taken under groundwater and surface water entitlements and will be purchasing up to \$3.1 billion of water entitlements. Both measures aim to deliver more water to the environment.

The Victorian Government believes key environmental assets in the Basin can be protected while preserving the rights of existing entitlement-holders. The best way to do this is to integrate the Commonwealth's plans with regional activities such as irrigation modernisation. A regionally-driven approach with community input is more likely to deliver better outcomes for communities, industries and the environment.

Traditional water-sharing arrangements in the *Murray-Darling Basin Agreement* have not worked well under extremely dry conditions and need to be changed. There is an unacceptable risk of insufficient water in some years to operate the River Murray – even to deliver critical human needs.

Key actions

-  Negotiate with the Commonwealth to:
 - protect existing water entitlements
 - recognise that better environmental outcomes are not just about more water and that infrastructure investment can optimise the benefits
 - clarify roles and responsibilities in Basin water management
-  Improve water-sharing arrangements in the *Murray-Darling Basin Agreement*, including the establishment of a River Murray operating reserve to ensure river operations during droughts.

Secure rights to water (see Chapter 4)





Victoria's water management arrangements will be robust and clear during droughts and entitlement-holders' rights to water will be secure.

Victoria's entitlement framework allocated water effectively for 100 years, but the dry conditions of the last 12 years have highlighted areas for improvement. The Strategy aims to ensure rights to water are secure and well managed with clear rules.

Licensing arrangements for water use from unregulated river and groundwater systems have been improved in recent years as both the level of understanding of these systems and water demand have increased. With the predicted increases in drought severity and duration, restrictions and bans on extraction are likely to occur more often and the Strategy includes actions to better manage water during these periods.

Water uses that were once insignificant now represent a larger proportion of total consumption. For example, the increase in domestic and stock use can affect the reliability of supply for other water users and the environment.

Key actions

-  Improve clarity and management of groundwater and unregulated water licences (Section 51 licences).
-  Register all new domestic and stock use in rural residential areas and establish 'reasonable domestic and stock' guidelines.
-  Amend bulk entitlements to reduce ad hoc decision-making during droughts, and improve certainty for entitlement-holders.
-  Revise environmental entitlements to improve the use of environmental water and better share the risk of future climate change.

Certainty and flexibility for entitlement-holders (see Chapter 5)

Entitlement-holders in the Northern Region will have improved choice and flexibility to help manage water-related business risks.

With less water available, urban water corporations may not be able to meet critical human needs, irrigators may have insufficient allocations to grow their crops and environmental allocations may be inadequate to protect refuges for important plant and animal populations.






The Strategy offers the best science available about the future availability of water and provides the tools to help users better manage their supplies and their risks.

The water market enables irrigators to buy additional water when allocations are low or to generate revenue by selling their allocations. Carryover allows irrigators and environmental managers to transfer part of their unused water allocation to the following season. This is a particularly important tool in dry years because it provides water at the beginning of the season when allocations may be low.

A key element of the Strategy is to ensure the distribution system can be run, even in severe drought years.

Actions are identified to help irrigators, the environment, towns, cities and the broader community adapt to climate change and variability.

Key actions

-  Increase system reserves to ensure distribution systems can be relied upon to deliver water when and where it is needed, even in severe droughts.
-  Improve the value of carryover as a tool to manage the risk of water scarcity by introducing arrangements to decrease the risk of entitlement-holders losing water they have carried over in full allocation years.
-  Change the rules to allow exemptions from the four per cent limit on trade out of irrigation districts when purchases are linked to modernisation programs.
-  Implement legislation that was passed in September, 2009 that removed the 10 per cent limit on ownership of water shares by non-landholders.
-  Clarify the timing of final allocations and how the irrigation season could be shortened during extreme droughts to provide greater certainty for entitlement-holders.

Efficient and sustainable irrigation (see Chapter 6)




The Northern Region will have a profitable and resilient irrigation sector serviced by modernised water distribution system infrastructure and management systems.

If there will be less water for irrigation, there will probably be less irrigated land in the Northern Region. The challenge is to find ways to support efficient, sustainable and high-value irrigation in the face of water scarcity, and this work is already underway.

The \$2 billion Northern Victorian Irrigation Renewal Project (NVIRP) to modernise irrigation distribution systems, and the Sunraysia Modernisation Project will improve the viability of irrigation industries. These significant infrastructure projects include channel automation, asset rationalisation, channel bank remodelling, the lining or piping of channels and metering upgrades to reduce losses and generate water savings for consumptive or environmental use.

There are also opportunities to help farmers reduce water use while getting the best out of food production, but additional investment is required. This investment includes the Commonwealth Government's \$300 million program to help farmers in southern Murray-Darling Basin states improve on-farm water efficiency.

Key actions

-  Encourage the Commonwealth to direct its water purchases to less productive areas by selectively exempting purchases from the four per cent trading limit.
-  Co-ordinate the rollout of Victorian and Commonwealth Government investment in NVIRP.
-  Link NVIRP to comprehensive on-farm programs, including integration with whole farm planning and the Commonwealth's \$300 million on-farm program.
-  Allow for a greater range of options in rationalisation and facilitate changed land management practices.
-  Improve salinity management to reduce the off-site impacts of irrigation.

High-value rivers, wetlands and floodplains (see Chapter 7)

The river, wetland and floodplain sites of greatest significance to the community will be protected.

Protecting the Northern Region's natural assets from the effects of prolonged drought and climate change requires a stronger and more coordinated approach. Additional entitlement from the investment in water saving projects, such as NVIRP and the Living Murray initiative, will be used to protect the highest value sites.

The recovery and use of environmental water will be better managed and informed by the best science available. Infrastructure to regulate flows, and complementary activities such as revegetation and bank erosion works, will be used under an adaptive and integrated management approach.

Priorities are identified for additional water recovery; these are linked to the outcomes expected in our rivers and wetlands and will be used to guide the Commonwealth purchase and water savings programs.

There is also a clear plan for changing environmental objectives, if necessary, following the 15-year review of Victoria's water resources, due in 2019.

Key actions

- Identify target volumes for water recovery to guide the Commonwealth's \$3.1 billion buy-back program.
- Establish a Victorian Environmental Water Holder to coordinate and better prioritise the delivery of environmental water across the region.
- Identify the need for structural works to improve environmental benefits and reduce the need for environmental water recovery.
- Improve the efficiency of environmental water use by introducing innovative carryover arrangements (available to all entitlement-holders) and through the reuse of return flows, complementary works and consumptive water en route.
- Establish clear processes for adapting the way we manage rivers and wetlands, including environmental water use, to suit seasonal conditions in a given year.
- Develop a reasoned and transparent process to change environmental objectives if necessary while ensuring this is not done prematurely.

Safe and secure drinking supplies (see Chapter 8)

People in the Northern Region will continue to have access to safe and reliable drinking water.

The supply of, and demand for, water has changed in response to drought. Urban water corporations have taken action to supplement supplies and to work with customers and communities to lower the demand for water.

A qualification of rights is currently used to make sure water corporations can supply critical human needs in extreme drought, but this creates more uncertainty for entitlement-holders and a better approach is needed.

Corporations need more flexible carryover arrangements and greater access to the water market to meet the future water demands from urban consumers.

Key actions

- Introduce flexible carryover so water corporations can ensure sufficient supplies for urban growth and acceptable service levels.
- Allow businesses and community groups in urban areas to buy water to avoid the most severe impacts of water restrictions.
- Expand the water grid to connect urban centres and piped supply systems for reliable reticulated water supplies to domestic and stock users.
- Update drought response plans to ensure their continued effectiveness in severe and prolonged droughts.

Prosperous, dynamic and resilient communities (see Chapter 9)

The Northern Region will remain strong and prosperous by adapting to a future with less water.

Water is an essential life-sustaining source. Decisions about water affect almost every aspect of people's lives, including their health, regional economies and the environment. Community involvement in decision making is essential. The Strategy aims to improve 'water literacy' in the Northern Region and identify the planning processes in which community members can become involved.

Communities throughout the region are experiencing significant change and sometimes difficult adjustment, and ways to ease stress and anxiety, such as community support programs, are identified.

Key actions



Involve more community members in decisions about water, to ensure their values are reflected.



Establish clear principles for government actions to support adjustment and encourage the Commonwealth to consider the community impacts of its water reform programs.



Establish a scholarship for Traditional Owners to develop skills and provide greater input into water resource management.

Conclusion

The Northern Region Sustainable Water Strategy will help the region prepare for a future distinguished by dynamic, prosperous, healthy and resilient communities; efficient and sustainable agriculture, manufacturing and services industries; and diverse and robust river, wetland and floodplain ecosystems.

The actions identified will be implemented and monitored over the next seven to 10 years.

The Strategy is the result of extraordinary collaboration between farmers, environmentalists, businesses, Traditional Owners, government, independent experts and organisations and community members with a broad range of interests in the region.

Looking ahead 50 years, the Strategy will be seen as a decisive step in northern Victoria's response to prolonged drought and the uncertainty of climate change.



Solitary Eucalypt late afternoon, Dry Diggings

Photographer: Alison Pouliot



1

The Northern Region Sustainable Water Strategy will guide the region's response to future droughts and the uncertainty of climate change.

What is the Northern Region Sustainable Water Strategy?

1

Guide to the chapter

Section 1.1 Role of regional sustainable water strategies

Section 1.2 The Northern Region

Section 1.3 Guiding principles

Section 1.4 The Strategy process

- Assessing potential responses

Key points of the chapter

-  The Northern Region takes in Victoria's share of the River Murray and the major Victorian rivers that flow north into it.
-  The Strategy identifies and analyses threats to water availability and quality. It sets out actions to ensure water entitlements are secure and provides more choice and flexibility for entitlement-holders to manage the risks imposed by drought and climate change.
-  The Strategy is the result of an 18 month collaborative process involving government departments, independent experts, key stakeholders in the water industry and the broader regional community.

1.1 Role of regional sustainable water strategies

Sustainable water strategies take a long-term view of water resource planning, considering all sources of water and the needs of towns, industry, agriculture and the environment. They guide the development, integration and implementation of management plans prepared by water corporations and catchment management authorities operating within each region.

Regional sustainable water strategies were legislated through the 2005 amendments to the *Water Act 1989* and fulfil Victoria's commitment to the National Water Initiative to carry out open, statutory-based water planning.

The Northern Region Sustainable Water Strategy aims to:

- identify and understand threats to water availability and quality, including the implications of climate change and variability
- help regional communities to adjust to reduced water availability
- ensure secure water entitlements for towns, industry and the environment
- encourage economically viable and sustainable agriculture
- improve choice and flexibility for entitlement-holders to manage the risks of climate change and variability
- protect and where possible, improve the health of rivers, wetlands and aquifers from the impacts of drought, climate change and variability and other risks
- recognise and respond to Indigenous and other cultural and heritage values associated with the region's rivers and catchment areas.



Grapevines, McIvor Estate

1.2 The Northern Region

The Northern Region includes Victoria's share of the River Murray and the major Victorian tributaries that flow north into it including the Kiewa, Ovens, Broken, Goulburn, Campaspe and Loddon rivers (see Figure 1.1). Major groundwater management areas in the region include the Upper and Lower Ovens, Mid-Goulburn, Shepparton Irrigation, Katunga, Campaspe Deep Lead, Mid and Upper Loddon. Major urban centres in the region include Wodonga, Wangaratta, Benalla, Shepparton, Bendigo, Swan Hill and Mildura.

Rural water supplies are managed by Goulburn-Murray Water and Lower Murray Water and urban supplies are managed by North East Water, Goulburn Valley Water, Central Highlands Water, Coliban Water and Lower Murray Water. The Northern Region *does not* include the urban supply systems of Avoca, Amphitheatre, Ballarat, Beaufort, Blackwood, Forest Hill, Landsborough, Learmonth and Redbank which are managed by Central Highlands Water and the towns Borung, Korong Vale, Wedderburn and Wychitella on the Wimmera-Mallee system which are supplied by Coliban Water.

The role as caretakers of river health in the region is shared by the North East Catchment Management Authority, Goulburn Broken Catchment Management Authority, North Central Catchment Management Authority and Mallee Catchment Management Authority.

See page 171 for a full outline of key roles and responsibilities in water resource management.

Figure 1.1 The Northern Region



1.3 Guiding principles

The following principles guide the Strategy, providing the framework for assessing options to secure northern Victoria's water future:

Shared responsibility and shared benefit

- > Everyone needs to act to secure water.
- > All entitlement-holders need to share the risk of reduced water availability caused by climate change. This includes rural and urban water users and the environment.
- > Overall community benefits will be maximised and no generation or group will incur unwarranted extra costs or receive additional benefits.
- > All stakeholders will be treated equitably.

Recognising existing rights and entitlements

- > Entitlements will remain secure with legal tenure that is certain and protected.
- > The right to a share of the available resource will be protected, even if reliability is reduced due to climate change.
- > If actions have material third party impacts, these impacts will be defined and minimised, mitigated, offset or compensated by the beneficiary.
- > In defining impacts on existing rights, the assessment will be appropriate to the magnitude of the impact and accuracy of information available.

Allowing individuals to manage their own risk and exercise their choices

- > Strategy actions will aim to maximise the ability of entitlement-holders to manage their own risk.
- > As far as possible, risk will be the responsibility of those best equipped to manage it – in most cases, this will be individual entitlement-holders.
- > Strategy actions will facilitate informed decision-making and maximise the ability of individuals to exercise choice.



Hay near Myrtleford

Photographer: Emily Hart

Being prepared without acting prematurely

- > Strategy actions and policies will be robust under all water availability scenarios.
- > Strategy actions will aim to address the risks associated with severe climate change – avoiding unacceptable costs if this doesn't occur.
- > Ongoing monitoring and evaluation will facilitate adaptive management to ensure that we will be prepared for the future as it unfolds.

Maximising efficiency and seeking multiple benefits

- > Water is scarce and will be delivered and used as efficiently and effectively as possible to maximise the benefits – for water users, the environment and the broader community.
- > Strategy actions will target multiple benefits – economic, social, cultural and environmental.

Maximising environmental outcomes

- > Strategy actions, when considered together, will aim to result in no net negative impacts and where possible, environmental gain.
- > Strategy actions will aim to protect or enhance ecological values.
- > Strategy actions will seek opportunities to improve water delivery and outcomes for the environment.

Socially responsible decision-making

- > Decisions about water resource management will be socially responsible and consider economic, social and environmental impacts.
- > Decisions about water sharing will be equitable and reflect community values (as sought through the Strategy's consultation processes, which will be open and transparent).
- > Strategy actions will be transparent in terms of the benefits gained or costs imposed (that is, trade-offs).
- > Decisions about Strategy actions will consider impacts at all scales, including on:
 - individuals
 - businesses (farm and non-farm)
 - local, regional and State communities
 - Commonwealth/national objectives.

1.4 The Strategy process

The Northern Region Sustainable Water Strategy is the result of an 18 month collaborative process involving Government departments, independent experts, key water industry stakeholders, including urban, rural and environmental water users and the broader regional community. Major outputs from the process are outlined in Figure 1.2.

The Minister for Water appointed a Consultative Committee of regional stakeholders to provide strategic guidance and oversight of the Strategy's development, (see Table 1.1). The committee met 15 times between January 2008 and August 2009. Its deliberations helped shape the required technical work and provided local perspective on the Strategy's consultation, option development and assessment processes.

Figure 1.2 How the Northern Region Sustainable Water Strategy was developed



Table 1.1 Consultative Committee members

<i>Independent Chair</i>	<i>Denis Flett</i>
Department of Sustainability and Environment	John Cooke, Tony Long, Campbell Fitzpatrick and Jane Doolan
Department of Primary Industries	Neil McBeath
Murray-Darling Basin Commission/Authority	Wendy Craik / Katrina McGuire
Victorian Farmers Federation	Richard Anderson
Northern Victoria Irrigators	Barry Croke
Community representative	John Dainton
Fruit Growers Victoria	John Wilson
Australian Dried Fruits Association	Tony Martin
United Dairy Farmers of Victoria	Ian Cobbledick
Municipal Association of Victoria	Neil Repacholi and Barbara Murdoch
Australian Conservation Foundation (until November 2008)	Paul Sinclair
Environment Victoria	Juliet Le Feuvre
North East Catchment Management Authority	John Riddiford
Goulburn Broken Catchment Management Authority	Bill O'Kane
North Central Catchment Management Authority	Gavin Hanlon / Damian Wells
Mallee Catchment Management Authority	Jenny Collins
North East Water	Jim Martin / Craig Heiner
Goulburn Valley Water	Laurie Gleeson / Peter Quinn
Coliban Water	Geoff Michell / Gavin Hanlon
Central Highlands Water	Neil Brennan
Goulburn-Murray Water	Garry Smith / Ian Moorhouse
Lower Murray Water	Owen Russell
First Mildura Irrigation Trust (until August 2008)	Ian Matheson

Allocation, environment, licensing and urban working groups were established to support the Committee. Membership included regional water corporations and catchment management authorities, irrigators, peak industry representatives and local environment group members. Members came from across northern Victoria including the Sunraysia, North Central, Goulburn Broken and north eastern areas. Collectively these groups met 15 times between January 2008 and September 2008 to identify and assess options to be included in the Draft Strategy. The allocation and environment groups reconvened between December 2008 and March 2009 to provide input to a review of carryover arrangements. These and the licensing group continued to meet to provide advice on actions and policies in the Strategy.

Consultation occurred with Traditional Owner groups across the Northern Region (see Table 1.2). Although each group in the Northern Region has its own unique way of operating and its own issues and aspirations several key points were consistently made in relation to future water management in the Northern Region, including:

- the importance of health of Country
- ensuring that Traditional Owners are active participants in managing water.

Further information on the issues, concerns and aspirations raised by Northern Region Traditional Owners can be found in Background Report 11.

Table 1.2 Indigenous groups consulted in the development of the Strategy

Bangerang People	Nyera Nyera People
Barapabarapa People	Tati Tati People
Dhudoroa People	Taungurung People
Dja Dja Wurrung People	Wadi Wadi People
Jarra Jarra People	Wamba Wamba People
Latji Latji People	Way Wuru People
Ngintait People	Yorta Yorta People

Regional stakeholders hosted more than 75 briefings and meetings with local communities and two public comment periods drew 135 and 177 submissions respectively. These submissions provided a range of perspectives from the irrigation, environment, tourism, cultural and industry sectors and were used in developing and assessing options for inclusion in this Strategy.

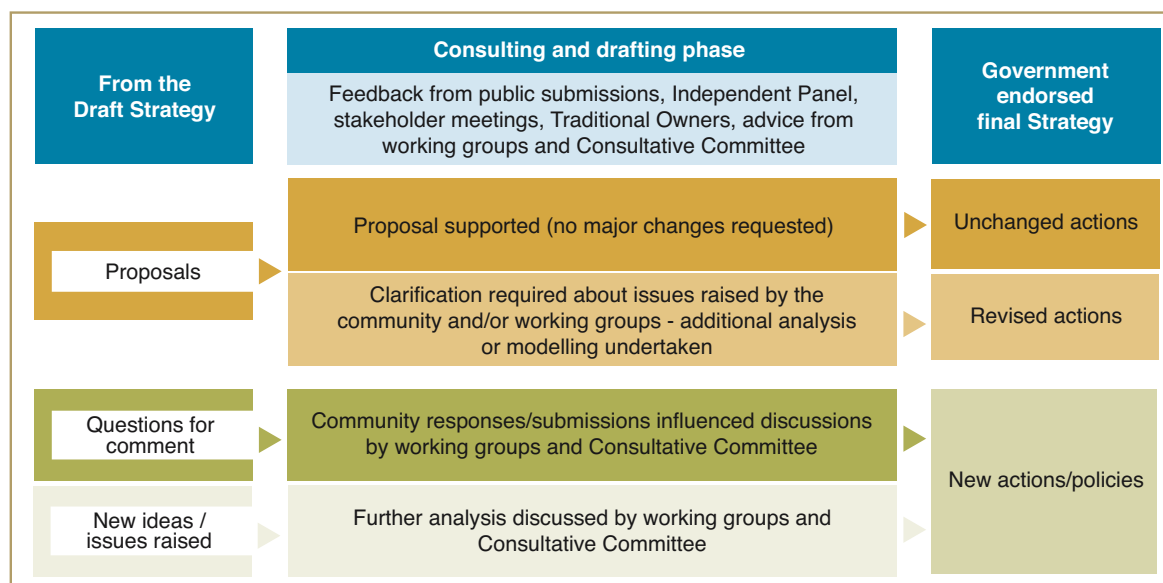
Other opportunities for the community to provide input included briefings for boards and customer committees of water corporations and catchment management authorities, briefings with local government (including the Municipal Association of Victoria), irrigation and environment peak industry groups (for example, grower groups, Victorian Farmers Federation, Environment Victoria) and special interest groups (for example, Upper Murray Agribusiness, Murray Campaign Committee, Waterwatch and Landcare groups).

1.4.1 Assessing potential responses

The consultation program helped to identify, filter and progress key proposals (from the Draft Strategy) into the actions and policies committed to in this Strategy (see Figure 1.3). In particular, deliberations by the Consultative Committee and working groups helped to assess each option against the Strategy's guiding principles and identify where further hydrological modelling and socio-economic data was needed. Background Report 12 provides more information about the results of this analysis and additional analysis completed between the Draft and this Strategy.

An Independent Panel was appointed by the Minister for Water to consider public submissions and other feedback from the consultation program. Appendix 1 provides information on the role and membership of the Panel and outlines the government's response to the Panel's key findings on the Draft Strategy submissions. Public submissions and the Panel's reports are available at www.ourwater.vic.gov.au/programs/sws/northern/submissions.

Figure 1.3 Process to develop Draft Strategy proposals into Strategy actions



Reference Guide #1:

Tier 1 - Rights held by Crown



Tier 2 - Rights to authorities

Environmental water reserve

- Environmental entitlements
- Obligations on consumptive entitlements
- 'Above cap' water

Bulk entitlements

- Source bulk entitlements
- Delivery bulk entitlements

Tier 3 - Rights granted to individuals

Rights to water

Water shares

Section 51 licences

Section 8 rights

Supplies to urban customers

Supplies by agreement

Associated entitlements

Delivery shares

Water-use licences

Section 67 licences

Water entitlements

Water entitlements are defined in the *Water Act 1989* and are issued by the Minister for Water. A water entitlement is the amount of water authorised to be stored, taken and used by a person under specific conditions. Associated entitlements set conditions for water delivery or use.

Environmental water reserve (EWR)

The EWR is the legally recognised amount of water set aside to meet environmental needs. The objective of the EWR is to preserve the environmental values and health of water ecosystems.

Environmental entitlements are generally identical in nature to bulk entitlements. They provide for a share of the available resource.

Obligations on entitlements include the passing flows that water corporations or licensed diverters are obliged to provide out of storage or past a diversion point. The portion of passing flows that is provided to meet environmental needs is considered a part of the EWR.

'Above cap' water includes water that is left over after limits on diversions have been reached and unregulated flows which cannot be kept in storage. Most of the EWR is comprised of 'above cap' water, and this component is most susceptible to climate change.

Bulk entitlements

Held by water corporations with secure tenure in perpetuity. They provide the right to water for system operations, seasonal allocations and other rights and obligations.

Source bulk entitlements provide a share of inflows, storage capacity (if applicable) and releases.

Delivery bulk entitlements provide a set volume of water each year, subject to defined restrictions during periods of water shortages.

Water shares have secure tenure held in perpetuity. A share of the available resource in most regulated systems is allocated annually (through seasonal allocations), which can then be ordered to a specified location, at a specified time and rate.

Section 51 licences allow for diversions from unregulated (and some regulated river systems) and extractions of groundwater. Licences are issued for a specified volume, period of time and with a range of conditions.

Section 8 rights provide for an individual to take and use water from a range of surface and groundwater sources for domestic and stock use under certain circumstances without a licence.

Supplies to urban customers must be provided by water corporations throughout their defined districts.

Supplies by agreement are arranged by water corporations to provide water outside of defined districts, and recycled and drainage water in special circumstances.

Delivery shares provide for water to be delivered to land in an irrigation district via a channel. Delivery shares are linked to delivery infrastructure and stay with the property if the water share is traded.

Water-use licences allow an irrigator to use water to irrigate land up to an annual use limit.

Section 67 licences provide for the construction of a groundwater bore or any works on a waterway, such as a private pump or dam, when a Section 51 licence is required.

Reference Guide #2

Limits on water entitlements

It is important that water allocation and diversions do not reduce reliability of supply for other entitlement-holders or impact on important environmental values. There are a range of tools to limit water entitlements to achieve this.

The Murray-Darling Basin Cap

limits the volume of surface water that can be diverted from each of the Basin's major rivers. The limit is set at the volume that was diverted under the 1993/94 levels of development. As a result, Victoria does not issue any new entitlements or licences unless water is created from water savings projects. Allocations to existing entitlements must remain below the Cap.

Permissible consumptive

volumes (PCVs) are the maximum volume of water that can be used for consumptive purposes for groundwater or surface water. PCVs are progressively being set for all groundwater management areas and water supply protection areas. For these areas, licences are not issued if the PCV is already reached or if licences would cause it to be exceeded.

Sustainable diversion limits

(SDLs) limit water use in unregulated systems. They prevent the issuing of summer licences and determine the upper limit on winter-fill diversions, beyond which there is an unacceptable risk to the environment. SDLs have been set for 1,584 sub-catchments across Victoria. They determine if a licence can be traded from one sub-catchment to another.

Key processes to change entitlements

To protect the integrity of Victoria's entitlements, the Water Act 1989 outlines clear, consultative processes that must be undertaken before entitlements can be changed.

Permanent changes

15-year review of water resources

A water resource assessment must be undertaken every 15 years to identify if there has been any long-term reduction in water availability and whether this has fallen disproportionately on water users or the environment. It will also identify any flow-related deterioration in waterway health. If either is the case, a review must be undertaken to determine the appropriate action considering social, economic and environmental values. This could include a permanent change to entitlements. The first 15-year review is due in 2019.

Management plans for water supply protection areas

In highly stressed groundwater and unregulated river systems, a management plan can be used to change conditions on Section 51 licences to ensure long-term sustainable use.

Temporary changes

Qualification of rights

The *Water Act 1989* provides the Minister for Water, (as a last resort under severe conditions) with powers to declare a water shortage and temporarily override existing water entitlements to reallocate water to priority uses. This process is known as a qualification of rights. In effect, water is taken from some entitlement-holders and used to supply others; normally to meet critical human needs.

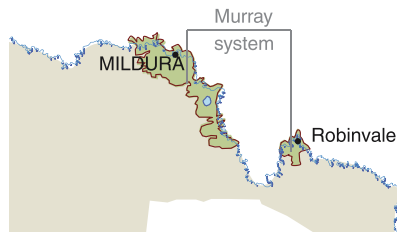
Critical human needs can be defined as the amount of water required to meet Stage 4 restricted demand in urban areas, supply domestic and stock needs and operate the distribution system to deliver that water.

As qualifications advantage one group of water users at the expense of another, generally with no compensation, qualifying rights is undertaken only in line with clear and transparent guidelines.

Victorian Water Register

To improve the recording and transparency of its water entitlements, Victoria has developed the Victorian Water Register (see www.waterregister.vic.gov.au). The register records bulk entitlements, environmental entitlements, water shares and licences to improve integrity and enable proper water accounting. It keeps track of the water market and produces crucial information for managing the State's water resources.

Water resource management



A river basin or system is the area of land where surface water run-off drains into streams and creeks that eventually flow into a single river. These streams and creeks are known as 'tributaries'.

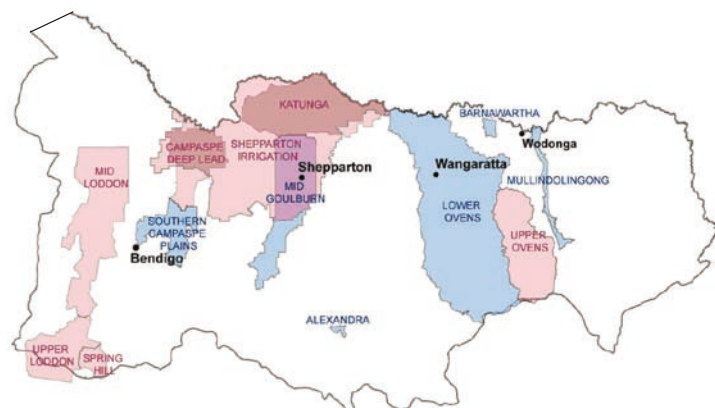
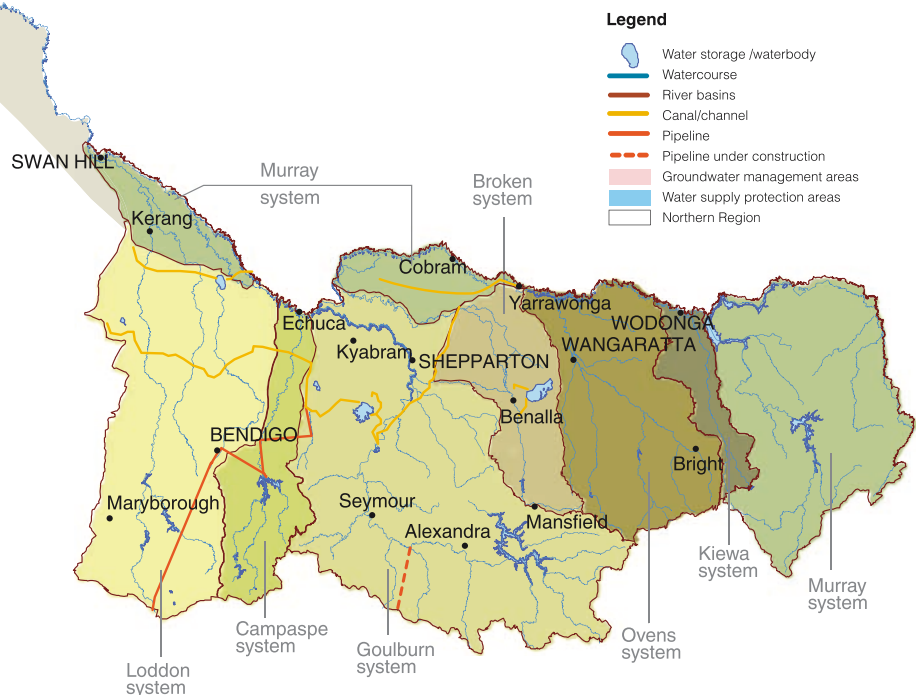
Water supply protection areas (WSPAs) can be declared where strict management is required to protect the groundwater and/or surface water resources in the area. Once an area has been declared, a management plan is prepared.

Groundwater management areas (GMAs) are the defined areas from which water is extracted from an aquifer, generally where groundwater has been well developed or has the potential to be developed.

Unincorporated areas are generally areas in which groundwater resources are of poor quality and yield.

Management areas

Current management areas define the scale at which diversion limits and other plans will be applied.



Responding to seasonal variability

Water availability varies considerably from year to year. This means an entitlement-holder may not always have access to their full entitlement volume. Annual use is determined by the following methods.

Seasonal allocations are the volume of water provided to water share-holders in a given year, expressed as a percentage of the total entitlement volume.

Urban water restrictions are introduced by water corporations in towns and cities to restrict outdoor use in times of shortage.

Rosters, restrictions and bans are applied in unregulated river and groundwater systems to limit the timing or amount of water extraction. The rules for applying these are documented in local management rules, or management plans.



10

This chapter describes how the Strategy will be implemented, funded and reviewed.



Delivering the Strategy

Guide to the chapter

Section 10.1 Implementation responsibilities

- Paying for the Strategy
- Impacts on water pricing and service

Section 10.2 Reviewing the Strategy

Key points of the chapter

- 💧 Responsibility for implementing the Strategy sits with the Department of Sustainability and Environment, rural and urban water corporations and catchment management authorities.
- 💧 No Strategy actions require large capital investment, however some actions may result in water corporations reviewing their water pricing arrangements.
- 💧 Ongoing monitoring and evaluation will allow us to adapt our management approach when the Strategy is reviewed. The first review will occur by 2019 before the 15-year resource review and the implementation of the Murray-Darling Basin Plan in Victoria.

10.1 Implementation responsibilities

Many organisations are involved in water management in the Northern Region and all have a part to play in implementing this Strategy. Key responsibilities will rest with the Department of Sustainability and Environment, rural and urban water corporations and catchment management authorities. Implementation and timing are outlined with each of the specific actions in Chapters 3 to 9. There is a statutory requirement for the Department of Sustainability and Environment to report on the implementation of this Strategy in its annual report, which is tabled in Parliament.

10.1.1 Paying for the Strategy

No Strategy actions will require large capital investment; rather, the Strategy establishes or improves water policy and regulatory arrangements. As such, many actions will align with existing responsibilities within the Department of Sustainability and Environment. Actions of a strategic nature may need additional investment, including through the Environment Contribution Levy (for example, the VEW and Sustainable Irrigation Program will receive funding from the levy). Actions involving catchment management authorities will be implemented through existing funding arrangements, or with the assistance of the Department, negotiated on a case-by-case basis. Where actions are delegated to water corporations, costs may be recovered through water pricing arrangements.

10.1.2 Impact on water pricing

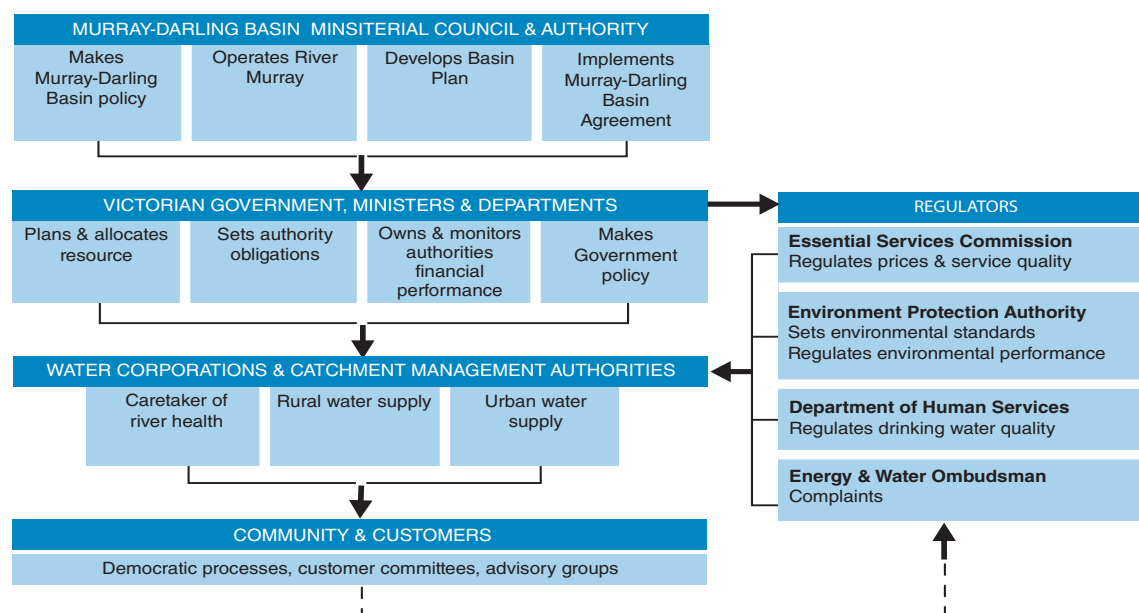
Water prices must be fair and independently managed. A framework for improved water pricing principles was outlined in *Our Water Our Future*, including:

- pricing structures that reward water conservation and efficiency and where possible to use water of a quality that is fit for purpose
- requiring water corporations to contribute funding towards water-related initiatives to improve water resource management across Victoria
- having water prices that fully recover the costs of sustainably managing water resources.

The ESC is the independent economic regulator of the water industry and is responsible for protecting the long-term interests of Victorian customers. Every five years, each water corporation must submit a water plan to the ESC. The water plan describes how they will deliver projects and service standards, the revenue required to do this, and an outline of proposed customer charges. The ESC publicly reviews these plans and then approves a package of prices and services the businesses must provide.

In addition to general pricing reviews, water corporations within the Northern Region will need to review the implementation actions assigned to them within this Strategy and determine how and when the costs should be recovered, including whether it would seek approval from the ESC to amend its current water plan and prices or seek to recover the costs as part of the next price review.

Figure 10.1 Roles and responsibilities in water resource management



10.2 Reviewing the Strategy

An adaptive management approach is critical to managing future certainties about water availability. Ongoing monitoring and evaluation will allow the management approach to be amended when the Strategy is reviewed. This gives the community the opportunity to respond to changing conditions with increased capacity and knowledge.

Under the *Water Act 1989*, the Minister for Water may review the Strategy at any stage, but it must be reviewed at least every 10 years. It is proposed that the first review will be completed by 2019 before Victoria's first 15-year resource review and the implementation of the Murray-Darling Basin Plan in Victoria (see page 11).



Cormorant, Cobram

Photographer: Bruce Cumming

Further information

Information about the Northern Region Sustainable Water Strategy is available from:

Department of Sustainability and Environment
136 186
www.ourwater.vic.gov.au/programs/sws/northern

Information regarding local water resource planning (including information about water supply/demand strategies) is available directly from water corporations:

Goulburn-Murray Water
(03) 5833 5500
www.g-mwater.com.au

Lower Murray Water
(03) 5051 3400
www.lmw.vic.gov.au

Coliban Water
1300 363 200
www.coliban.com.au

Goulburn Valley Water
(03) 5832 0400
www.gvwater.vic.gov.au

Central Highlands Water
(03) 5320 3100
www.chw.net.au

North East Water
1300 361 622
www.nerwa.vic.gov.au

Information regarding river and catchment health (including copies of regional river health strategies) is available from catchment management authorities:

Mallee Catchment Management Authority
(03) 5051 4377
www.malleecma.vic.gov.au

North Central Catchment Management Authority
(03) 5448 7124
www.nccma.vic.gov.au

Goulburn Broken Catchment Management Authority
(03) 5820 1100
www.gbcma.vic.gov.au

North East Catchment Management Authority
(02) 6043 7600
www.necma.vic.gov.au

Information regarding planning and management in the Murray-Darling Basin is available from:

Murray-Darling Basin Authority
(02) 6279 0100
www.mdba.gov.au

Information regarding climate data (including forecasts and seasonal outlooks) is available from:

Bureau of Meteorology
(03) 9669 4000
www.bom.gov.au

South Eastern Australian Climate Initiative (SEACI)
<http://www.mdbc.gov.au/subs/seaci/>

Victoria's climate change program
<http://www.climatechange.vic.gov.au/index.html>

Other useful community contacts:

Waterwatch
(03) 9637 9768
www.vic.waterwatch.org.au

Landcare
1800 151 105
www.landcareonline.com.au



Letterboxes

Photographer: Bruce Cumming



2

This chapter identifies key threats to water resources, and forecasts their impact on water availability and quality over the next 50 years.



Managing future threats to water resources

Guide to the chapter

Section 2.1 Sources and values of water

Section 2.2 Threats to water availability

- Climate variability and change
- Water regulation and extraction
- Interception activities

Section 2.3 Projection of water availability to 2055

Section 2.4 How will the available water be shared?

Section 2.5 Water availability for entitlement-holders

- Water share-holders
- Licence-holders on unregulated rivers
- Groundwater licence-holders
- Urban entitlements

Section 2.6 Water availability for the environment

- Regulated river systems
- Unregulated river systems
- Groundwater-dependent ecosystems

Section 2.7 Threats to water quality

- Salinity
- Pollution events
- Acid sulphate soils
- Bushfire

Section 2.8 Where to from here?

Key points of the chapter

- 💧 Surface water is the source of 91 per cent of the water used in the region.
- 💧 Irrigation accounts for 89 per cent of water use, while urban use accounts for about four per cent.
- 💧 Climate change is likely to be the biggest factor affecting future water availability, resulting in the next 50 years being drier and warmer than the past century. Other threats include climate variability (drought), water regulation and extraction and interception activities.
- 💧 It is possible that the low streamflows and inflows experienced since 1997 represent a major and ongoing change in water availability. The Strategy plans for the continuation of this as its most severe water availability scenario.
- 💧 If nothing is done, reduced water availability will result in: increased risk of zero allocation years for irrigators; greater frequency, severity and duration of urban water restrictions; and reduced environmental flows.
- 💧 Over the past 12 years there has been a disproportionate reduction in water availability for the environment compared with consumptive use. This is because most environmental water is provided by unregulated flows and spills from storages, rather than secure entitlements.

2.1 Sources and values of water

In the Northern Region surface water is the source of the vast majority of water used. On average, 91 per cent of total water use is surface water, five per cent is groundwater and four per cent is alternative sources; including stormwater and recycled water¹. There are about 485 GL of groundwater entitlements, which is 12 per cent of surface water entitlement volume (see Appendix 2 for more information).

The region's total surface water resources are 10,230 GL/year (long-term average), of which environmental flows account for 4,089 GL/year. Only six per cent of this is provided by environmental entitlements (see Appendix 4); the remainder comes from unregulated flows and spills from storage.

Of the surface water resources taken for consumptive use, 89 per cent is used for irrigation and other rural use and four per cent is used in urban areas (see Figure 2.1).

These different uses reflect the many important values supported by the region's water resources, including social, economic and environmental (see Figure 2.2).

Figure 2.1 Surface water use in the Northern Region (GL/year)²

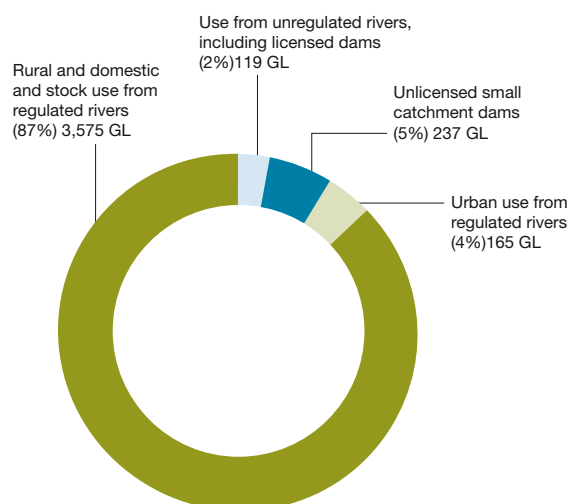
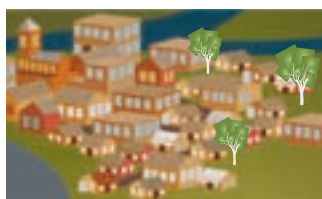


Figure 2.2 The many values supported by water



Agriculture

Agricultural production is a key factor in Victoria's ongoing prosperity, with horticulture, dairy and mixed farming enterprises underpinning regional economies.



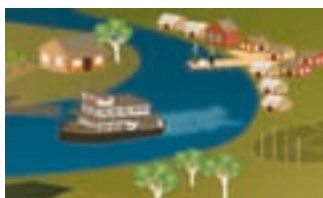
Towns and cities

Households, businesses and urban communities rely on safe, secure supplies for drinking, washing, maintaining sports grounds and open spaces, manufacturing and other industrial uses.



Environment

Healthy rivers, wetlands and floodplains are home to important plants and animals such as Murray cod, river red gums and migratory birds.



Recreation and tourism

Important recreational activities take place on or near rivers and wetlands, including fishing, water-skiing, boating, camping and picnicking. Resulting tourism supports regional economies.



Indigenous culture

The health of waterways and land remains central to Indigenous culture, particularly significant fish and bird species, plant foods and medicines.

2.2 Threats to water availability

The key risks to water availability include:

- climate change and variability
- water regulation and extraction
- interception activities such as small catchment dams, land use change and forest regeneration after bushfires.

2.2.1 Climate variability and change

Victoria's rainfall has a high level of seasonal and inter-annual variability and there are a range of factors that influence this variability (see Appendix 3). Rural and urban water supply systems have been designed to manage the variability experienced over the historic record. Climate change represents an additional influence and will probably be the biggest factor affecting future water availability. In all likelihood, climate change will result in the next 50 years being drier and warmer than the past century. Droughts are also expected to be more frequent and severe.

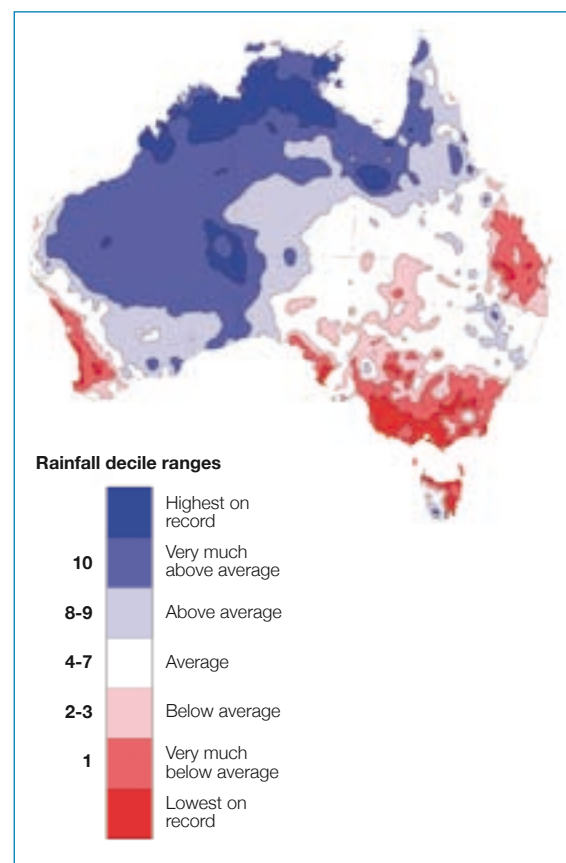
Victoria's rainfall, along with much of eastern Australia, has been experiencing a considerable downward trend since the 1970s. The past 12 years have been particularly dry with most of the Northern Region experiencing well below average rainfall (see Figure 2.3). Victoria's water entitlement framework has been designed to cope with drought, but the duration and severity of the low streamflows and inflows experienced since 1997 has limited the ability of people, industries, the environment and water storages to recover. The effects in the region have included:

- reduced allocations since 2002/03 for irrigation and urban water use, in line with the gradual reduction in storage levels
- significant pressure on the environment from reduced streamflows and allocations, with environmental water being directed towards maintaining drought refuges for plants and animals
- more severe and extended water restrictions for towns, impacting on households, industry and community and recreational activities
- reduced water availability for domestic and stock use, and additional impacts on dryland crops and pastures due to reduced rainfall
- more prolonged restrictions and bans in unregulated river and groundwater systems
- increased use of groundwater as a drought contingency water source and reduced groundwater recharge.

"The last 11 years of dry conditions have reduced the resilience of regional communities and their river systems, and many people are well aware that 'business as usual' is no longer an option."

– Draft Strategy submission DS161

Figure 2.3 Australian rainfall deciles
(1 October 1996 to 31 August 2009)³



The Strategy applies lessons from the past 12 years to be better prepared for future drought or permanent changes to water availability. Irrespective of the cause, there is little prospect of returning to the water availability of the past century and northern Victoria must be in a position to respond to a future with less water.

It is possible that the low streamflows and inflows experienced since 1997 represent a major and ongoing change in storage inflows. A similar change occurred in south-west Western Australia where inflows were reduced by about 50 per cent in 1975 and up to 64 per cent in the past 10 years (see Figure 2.4). Extensive research into the causes of the Western Australian changes in rainfall and inflows has shown that they result from large-scale atmospheric circulation changes which have resulted in an increase in average atmospheric pressures, a southward shift in storm tracks and a reduced potential for the development of storms. In turn, these changes are considered to result primarily from a combination of the enhanced greenhouse effect and natural variability. Ozone depletion may also be playing a role through its influence on the Southern Annular Mode (a mode of climate variability that involves alternating changes in storms and windiness between high and mid-latitudes). Similar factors are influencing Victoria's climate. In both regions, further research is necessary to better quantify the relative contributions of natural variability and the various human-induced forcings to the observed changes in climate (see www.ioci.org.au for more information).

Climate change – how do we know?

Victoria is an active participant in the South Eastern Australian Climate Initiative (SEACI), a research program established in 2006 (see www.seaci.org). This initiative aims to better understand the key climate drivers affecting south-eastern Australia over a range of timescales, and in particular, the causes of the dry conditions that have been experienced since 1997. Research released in 2008 concluded that there are now firm signals linking the current dry conditions to global warming. See Appendix 3 for an explanation of the known drivers of Victoria's climate.

SEACI has found that the key factor influencing the rainfall decline is a rise in atmospheric pressure in southern Australia, associated with an intensification of the sub-tropical ridge (a belt of high pressure located in the mid-latitudes, around 30-35 degrees south). This intensification weakens and shifts south the cold fronts and low-pressure systems that used to bring reliable rainfall to south-eastern Australia and accounts for 70 per cent of the reduced rainfall.

While natural variability will have played a part in the recent changes in climate, the clear link between the dry conditions and global warming identified by SEACI suggests that dry conditions may persist. Through SEACI, the Victorian Government is contributing to further research to better understand the relative roles of natural and human-induced forces in these changes. This work will be important in determining if, and to what extent, current and further rainfall declines can be expected as a result of climate change.

The Victorian Government is also committed to addressing the drivers of global warming by reducing greenhouse gas emissions and preparing for further changes to our climate. This work is being driven by the Department of Premier and Cabinet (see www.climatechange.vic.gov.au).

Figure 2.4 Annual inflows to Perth storages⁴

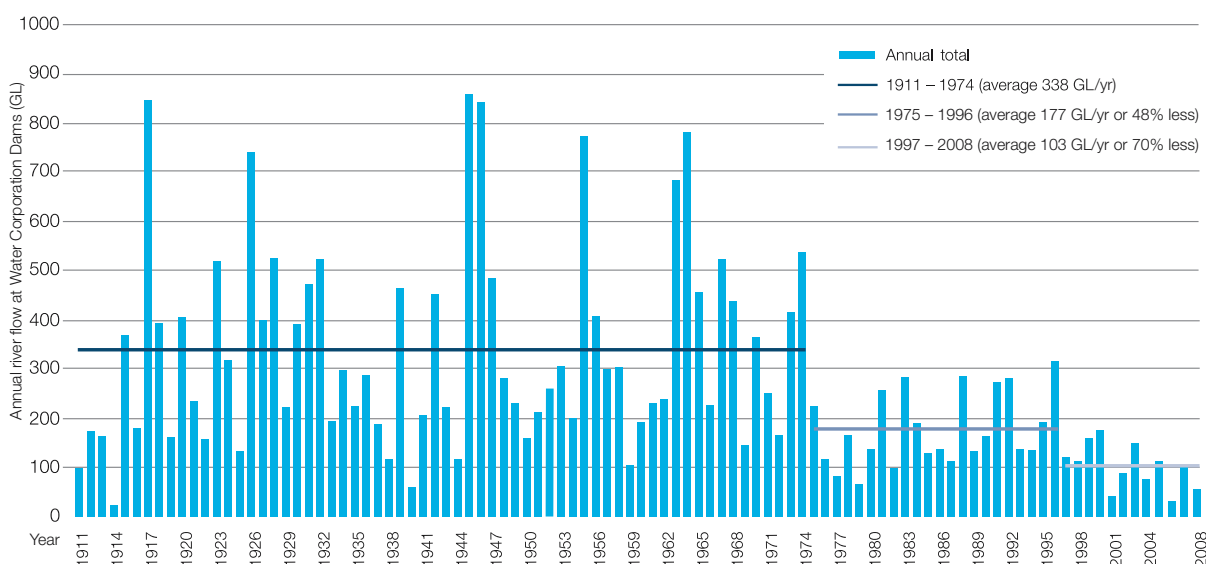


Figure 2.5 shows how climate change could impact on all aspects of the water cycle. Reduced rainfall and hotter temperatures are expected to result in drier soils, less run-off into rivers and storages and more evaporation from rivers, channels and storages.

Changes in rainfall and streamflow across Victoria over the past 12 years have generally been of the order of those expected under medium to high climate change projections by 2055. Across the state, there has already been a reduction in annual rainfall of about 13 per cent.

Reduced rainfall has resulted in a 44 per cent decline in inflows to rivers and storages in the River Murray between July 1997 and June 2007. Inflows in 2006/07 were 1,110 GL; the lowest on record at only 15 per cent of the pre-1997 average (see Figure 2.6). This was followed by another dry year, with inflows in 2007/08 only 2,128 GL. With inflows in 2008/09 also very low, these three years are tracking as the lowest, third lowest and seventh lowest inflows in the historic record across the Murray-Darling Basin⁵.

Victoria has experienced similar periods of reduced water availability in the past; notably in the early 1900s (Federation drought) and the mid-1930/40s (World War II drought). These past periods were not as severe, in terms of streamflow and inflow reductions, as this recent period which has had higher temperatures and potential evapotranspiration⁶. This recent period has also seen a complete absence of high rainfall years (that is, the loss of inter-annual variability) and there has been a disproportionately large decline in autumn and early winter rainfall. This has resulted in low winter-spring run-off and a decline in streamflows and inflows to surface water and groundwater storages.

Figure 2.5 Potential climate change impact on the water cycle by 2050⁷

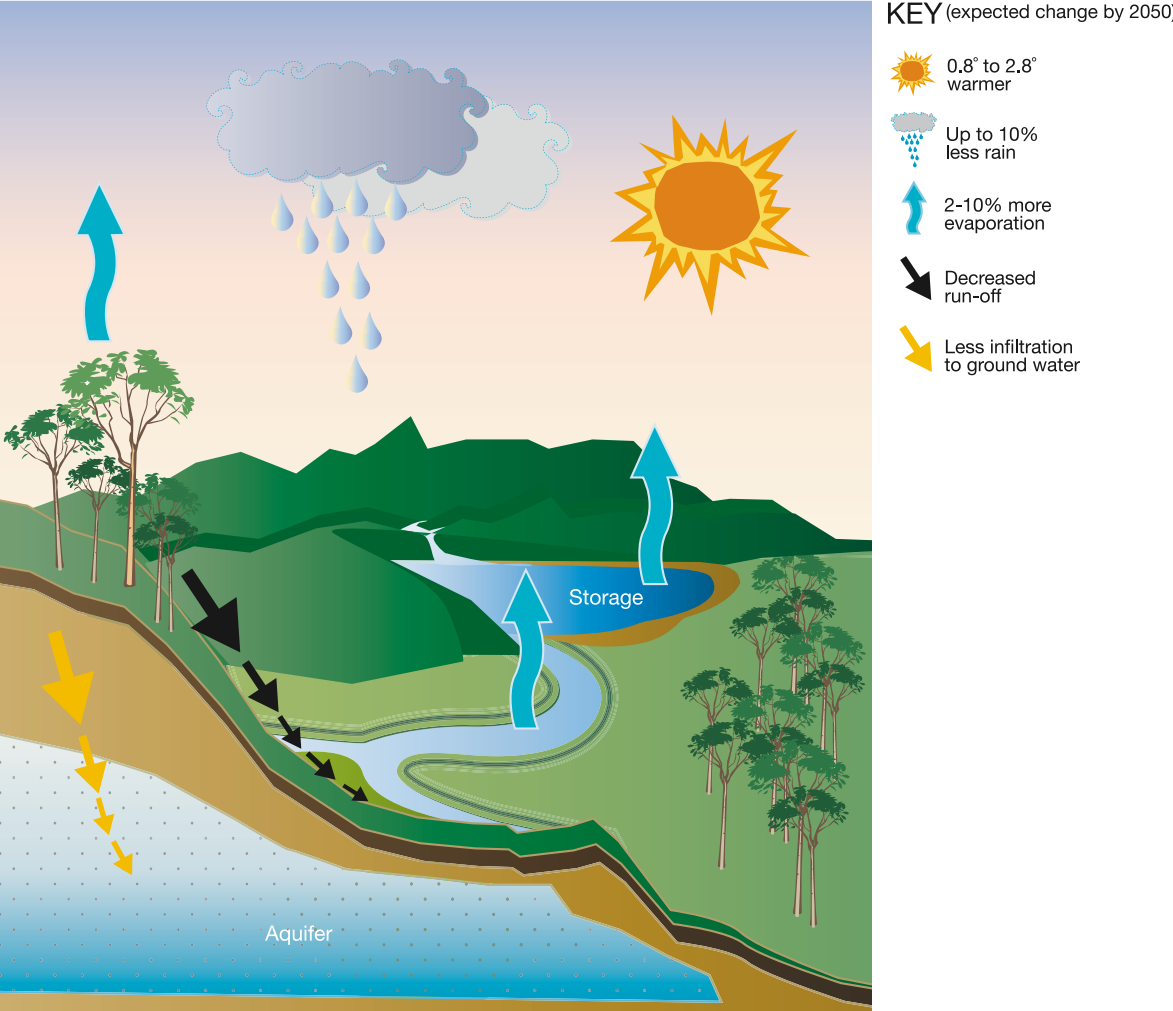
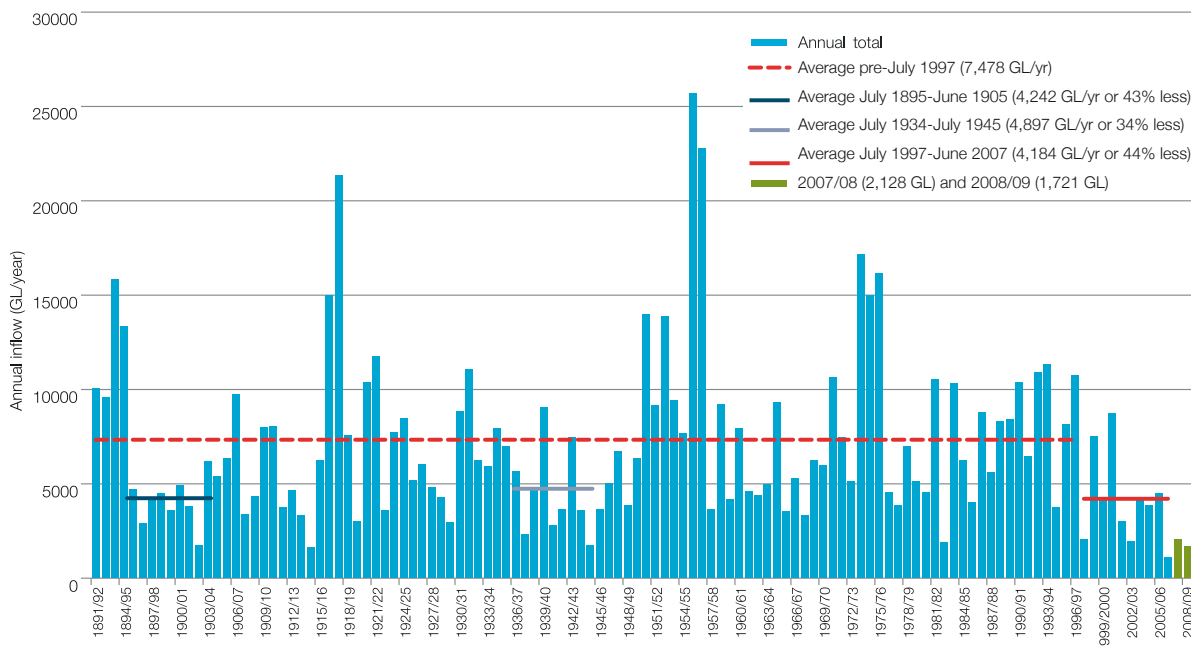


Figure 2.6 Annual inflows into Victoria's share of the River Murray system



Notes:

- Inflows include Snowy River transfers.
- Data produced from hydrological models.
- Data prior to 1900 is less robust than remaining dataset.
- Inflows for 2007/08 and 2008/09 are shown here but are not included in subsequent model runs as they were not available at the time. If included the post-1997 average inflow for Victoria's share of the River Murray would be 3,164 GL/yr or 49% less than the pre-1997 average.
- 2008/09 inflow data is an estimate only, calculated using available operational data.

2.2.3 Water regulation and extraction

It has long been recognised that the construction of large storages and the extraction of water have affected the condition of the region's rivers, wetlands, floodplains and aquifers. The effects of water regulation and extraction are likely to be exacerbated by the impacts of climate change and in many northern river systems, the water provided for the environment is inadequate to sustain ecological objectives. The Sustainable Rivers Audit undertaken in the Murray-Darling Basin found that the current condition of Victoria's northern rivers was poor⁸. In addition to a decline in ecological health, towns and industries that depend on reliable, high-quality water are impacted. Victoria and other Basin states have responded by introducing a cap to stop growth in water use and are investing in a range of projects to reallocate water from consumptive use to the environment (see page 130).

The CSIRO Sustainable Yields project (available at www.csiro.au) identified no over-allocated groundwater areas in northern Victoria. However, groundwater levels are declining due to an imbalance between rates of extraction and rates of recharge (see page 28).

In the future it will be necessary to constantly reassess community values to determine the appropriate balance of environmental and consumptive water use. The definitions of 'over-allocation' and 'sustainability' are a value judgement of the community of the day, and are likely to change over time (see pages 68 and 150 for further discussion).

2.2.2 Interception activities

Interception activities are a risk to water availability because they capture rainfall before it becomes surface runoff or groundwater recharge. These activities include small catchment dams (for farms or domestic and stock use), changes in land use and the impact of forest regeneration due to bushfires. These activities have not historically required a water entitlement (except for small catchment dams for irrigation or commercial purposes which have required a licence since 2002). However, they can reduce the amount of water available to downstream entitlement-holders and the environment.

As water availability decreases, interception activities harvest an increasing proportion of available water as they capture rainfall before it becomes runoff. It is difficult to forecast the full impact of interception activities, as they are variable over time (for example, with bushfires), or localised (for example, with plantations in the Northern Region). However, it is likely that in future, greater emphasis will be placed on accounting for the water use of interception activities (see Chapter 4 for more information).

Small catchment dams

Unlike dams for commercial and irrigation use, dams for domestic and stock use are not licensed and therefore can continue to be built without scrutiny of their impact on downstream users and the environment. Based on current estimates, unlicensed dams capture six per cent of the available surface water in northern Victoria. At a local level, the impact of unlicensed dams can be even greater. For example, with long-term average water availability, small catchment dams in the Campaspe system collectively intercept 11 per cent of streamflow. This increases to 16 per cent under medium climate change, and 29 per cent under a continuation of recent low inflows (see Background Report 1 for more detail and page 21 for water availability scenarios). In sub-catchments with a high density of small catchment dams, natural streamflow can be reduced by up to 77 per cent under a continuation of recent low inflows⁹.

Land use change

Land use change has the potential to impact significantly on water resources in Victoria. For example, a shift from pasture to plantations, or from annual to perennial pasture, can affect the water balance of a catchment by intercepting water that would otherwise become part of the surface or groundwater resource.

The impact of afforestation on water yield in the Northern Region is expected to be relatively low, though local impacts could occur. CSIRO Sustainable Yield Project¹⁰ forecasts an increase of 30,000 hectares in plantations by 2035 in the upper Murray (Victoria and New South Wales). This equates to the interception of 25 to 35 GL per year or 0.9 to 1.3 per cent of average annual yield.

Since the release of *Our Water Our Future* in 2004, progress has been made to quantify the impacts of the various land use changes on water resources across Victoria. Several policy options to account for and manage these changes have been identified and evaluated, including case studies in Gippsland, south-west and north-east Victoria. Drawing on this technical work and research, the State Government is currently determining the most appropriate policy response. The next stage of policy development will be undertaken through the Western Region Sustainable Water Strategy.

Regeneration after bushfires

Fires are a natural occurrence in the Australian landscape, and have a varying impact on water yield depending on the type of vegetation involved, the intensity and spatial extent of the fire, and the proportion of a catchment affected. Quantifying the future impact is limited by the unpredictable nature of bushfires, though the frequency and intensity is likely to increase as our climate becomes warmer and drier.

An increase in rainfall runoff is generally experienced for several years after a fire, due to the reduction in vegetation cover. In the longer term (20 to 80 years), surface and groundwater may be drawn upon as regenerating vegetation enters a phase of rapid growth. As forests mature, water use gradually tails off, eventually returning to pre-bushfire levels.

In 2002/03, fires in north-eastern Victoria burned almost 500,000 hectares of native forest¹¹. In addition, 400,000 hectares in the north-east was burnt in the 2006/07 fire season, including some areas that were previously affected in 2002/03. It is estimated that the maximum combined impacts of the 2002/03 and 2006/07 fires will be a reduction in average annual streamflows from catchments contributing to the River Murray of around 255 GL at around 2025. To put this in context, it represents about three per cent of average annual flows in the River Murray at the confluence with the Ovens River¹². This is a small impact compared to other threats.

The 2008/09 fire season saw the burning of just over 100,000 hectares in the Northern Region, including in part the firestorms that swept across Victoria on Black Saturday (7 February 2009). These fires were unprecedented in their intensity and ferocity. It is not yet known how these fires will impact on the region's water resources. See page 35 for information on the impact of bushfires on water quality.

2.3 Projection of water availability to 2055

The Strategy uses computer models to help project water availability. The models are important in long-term water planning because they provide some insight into what the future may look like, but also indicate of the range of uncertainty that will need to be managed. The following water availability scenarios have been modelled for the major regulated systems in the Northern Region:

- the base case – long-term average, based on the historic record from July 1890 to June 2007
- Scenario A – based on the CSIRO¹³ low climate change predictions
- Scenario B – based on the CSIRO medium climate change predictions
- Scenario C – based on the CSIRO high climate change predictions
- Scenario D – based on a continuation of recent low inflows (July 1997 - June 2007).

The Strategy examines two scenarios in detail – a continuation of recent low inflows (Scenario D) and the medium climate change predictions (Scenario B) and compares these to the base case. Focusing on Scenario D allows planning for a more severe scenario, which is more prudent than assuming inflows will soon return to historical conditions. However, this scenario may not eventuate and therefore it is also important to examine the impacts of the medium climate change projections. Comparing Scenario D and Scenario B with the long-term average (base case) illustrates the range of possible water availability scenarios.

The forecasts in Figure 2.7 highlight the uncertainty in predicting future water availability. It is possible that there may be a slight increase in water availability in the total Murray system in 50 years time (as a result of increased flows in the Darling River), although this is not the case for any other river systems in the Northern Region. Scenarios B and C predict a gradual reduction in water availability, while Scenario D shows the impact of an indefinite continuation of the extreme conditions experienced since 1997.

Modelling our water resources

The Strategy uses the Department of Sustainability and Environment's Resource Allocation Models (REALM) to simulate the operation of the region's water supply systems and show how urban and rural supplies and the environment may be affected by potential reductions in inflows.

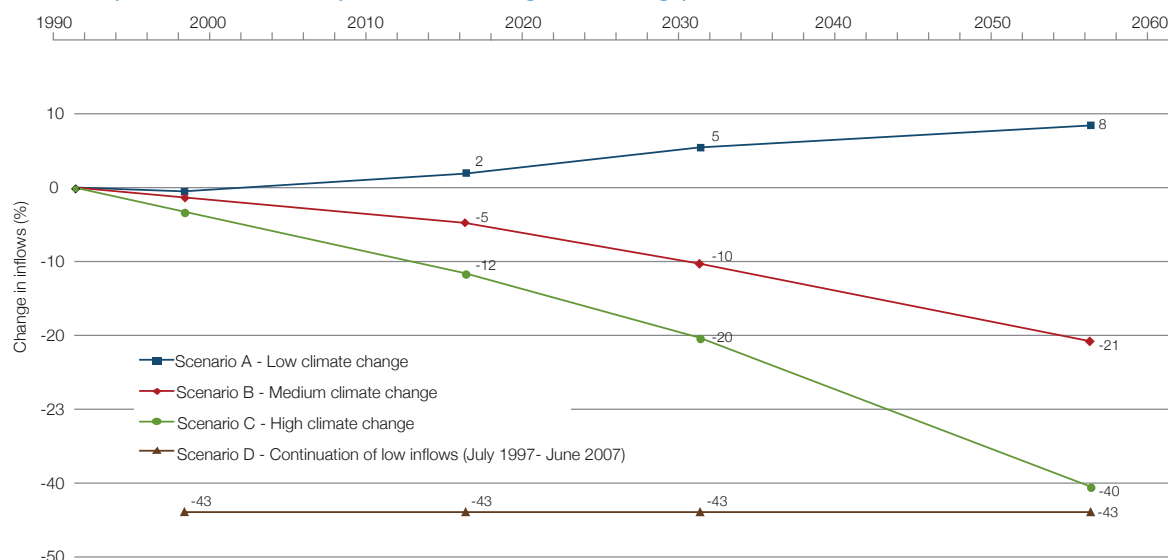
Two types of model runs were undertaken to develop the Strategy:

- 1) Water availability scenarios: these model runs assume the current system operating rules, with inflows affected by climate change. Climate scenarios A-C are formulated by applying a percentage reduction, determined by CSIRO predictions¹⁴, to the entire historic inflow record (July 1890 to June 2007). For Scenario D, the average reduction of July 1997 - June 2007 (from the long-term average) is applied to the entire historic record.
- 2) Option analysis: these model runs assume modified operating rules under base case and scenario inflows to demonstrate how management options would impact on reliability of supply and environmental flows under a range of water availability scenarios.

While Figure 2.6 provides estimates of inflow data for 2007/08 and 2008/09 (Victoria's share of the River Murray), inflows for these years were not included in the water availability scenarios, as the data was not available at the time of the model runs.

The Strategy's forecasts and those formulated through the CSIRO Sustainable Yields Project are very similar. However, the 'dry' and 'wet' scenarios used by CSIRO are more extreme than the 'high' and 'low' scenarios used in this Strategy. The methods used to model the dry inflows of recent years differed between the two projects. Despite this, both the Sustainable Yields Project and this Strategy present a consistent message of future reductions in water availability. Extensive work has been undertaken to ensure the models used are the best available, and they are continuously improved.

Figure 2.7 Forecast availability of inflows for the total Murray system* over 50 years (Scenarios A to D compared with the long-term average)¹⁵



Note: * Refers to total Murray system, not just Victoria's share.

Note that unless otherwise stated the Murray system refers only to Victoria's share of the resource, which comprises 50 per cent of the upper Murray, Kiewa and lower Darling, and all outflows from the other Victorian tributaries.

Table 2.1 shows the potential reduction in total inflows for each of the major river systems in the Northern Region (also see Background Report 2). The western catchments are likely to be more adversely affected than the eastern catchments and the impacts of recent low inflows are similar to or greater than those expected under the high climate change scenarios.

The current extended drought in the Northern Region has been more severe, in terms of streamflows, than any period on record. By applying lessons from the recent drought, Strategy actions will make sure the region is better prepared for similar or more extreme future droughts.

During consultation on the Draft Strategy some community members expressed concern that Scenario D was too extreme. The latest climate research indicates that the climatic conditions of the past 12 years may continue, with a link established between global warming and an intensification of the sub-tropical ridge (see Appendix 3). This possibility is supported by the experience in south-west Western Australia, a location that is affected by some of the same key climate influences as Victoria, where streamflows have been well below average for more than 30 years.

There were comments from some community members that long-term conditions could be more severe. If improved forecasts show a greater likelihood that the ongoing climate will be drier than Scenario D, further actions can be implemented. In the interim, the Strategy improves the region's capacity to manage through drier periods. This approach provides a balance between cost and readiness based on an uncertain future.

Table 2.1 Forecast change in total inflows in the major river systems in the Northern Region (compared with the long-term average)¹⁶

River system	Water availability scenarios at 2055			
	A – Low climate change	B – Medium climate change	C – High climate change	D – Continuation of low inflows (July 1997 - June 2007)
Murray*	+ 8%	-21%	-40%	-43%
Kiewa	-5%	-19%	-32%	-23%
Ovens	-6%	-24%	-41%	-33%
Broken	-7%	-31%	-51%	-53%
Goulburn	-7%	-25%	-43%	-49%
Campaspe	-9%	-31%	-54%	-72%
Loddon	-10%	-34%	-58%	-74%

Note: * Refers to total Murray system, not just Victoria's share.

2.4 How will the available water be shared?

Victoria's entitlement framework determines how available water is shared between various water users and the environment (see page 9). Tables 2.2 and 2.3 summarise how Scenarios B and D will reduce water availability for the major regulated systems in the Northern Region, compared with long-term averages. They show that there is a disproportionate impact on water available for the environment compared with water for consumptive use.

Please note that 'environmental water' refers to the outflows at the end of each system. As such, it includes water that may be used for consumptive purposes further downstream. For example, Goulburn environmental water includes consumptive water being delivered to entitlement-holders in Sunraysia.

Summary of Scenario B – Potential impact of medium climate change in 2055

- Overall water availability (total inflows) could be reduced by 25 per cent in the Goulburn system and 34 per cent in the Loddon.
- Water availability for consumptive use (diversions) could be reduced by three per cent in the Broken and 23 per cent in the Loddon.
- Water availability for the environment (environmental water) could be reduced by 28 per cent in the Murray and 49 per cent in the Campaspe.

Table 2.2 Forecast water availability under medium climate change (impact of Scenario B at 2055 compared with the long-term average)¹⁷

Expected impacts in 2055 - of medium climate change	River system				
	Murray ²	Broken	Goulburn	Campaspe ³	Loddon
Total inflows¹					
Long-term average ⁴	7,596 GL	281 GL	3,287 GL	305 GL	278 GL
Medium climate change	5,621 GL	194 GL	2,458 GL	211 GL	183 GL
Difference (%)	-1,975 GL (-26%)	-87 GL (-31%)	-829 GL (-25%)	-94 GL (-31%)	-95 GL (-34%)
Diversions for consumptive use					
Long-term average ⁴	1,697 GL	31 GL	1,638 GL	110 GL	102 GL
Medium climate change	1,563 GL	30 GL	1,389 GL	99 GL	79 GL
Difference (%)	-134 GL (-8%)	-1 GL (-3%)	-249 GL (-15%)	-11 GL (-10%)	-23 GL (-23%)
Environmental water⁵					
Long-term average ⁴	4,089 GL	184 GL	1,591	162 GL	109 GL
Medium climate change	2,951 GL	99 GL	980 GL	83 GL	58 GL
Difference (%)	-1,138 GL (-28%)	-85 GL (-46%)	-611 GL (-38%)	-79 GL (-49%)	-51 GL (-47%)

Notes:

1. Total inflows include diversions for consumptive use, environmental water, plus systems operating water. Excludes water use in unregulated systems and small catchment dams.

2. Murray diversions and inflows are Victorian shares only. Murray environmental water is Victorian flow at the South Australian border (including Living Murray Initiative commitments).

3. Campaspe diversions include Coliban River diversions for urban and irrigation supplies.

4. Calculated based on historic record July 1890-June 2007.

5. Environmental water is reflected by end of valley flows (ie. flows at the basin outlet).

Table 2.3 Forecast water availability under a continuation of recent low inflows
(impact of Scenario D compared with the long-term average)¹⁸

Immediate impacts of a continuation of recent low inflows (July 1997- June 2007)	River system				
	Murray ²	Broken	Goulburn	Campaspe ³	Loddon
Total inflows¹					
Long-term average ⁴	7,596 GL	281 GL	3,287 GL	305 GL	278 GL
Continuation of recent low inflows	4,408 GL	139 GL	1,704 GL	92 GL	77 GL
<i>Difference (%)⁵</i>	<i>-3,188 GL (-42%)</i>	<i>-142 GL (-51%)</i>	<i>-1,583 GL (-48%)</i>	<i>-213 GL (-70%)</i>	<i>-201 GL (-72%)</i>
Diversions for consumptive use					
Long-term average ⁴	1,697 GL	31 GL	1,638 GL	110 GL	102 GL
Continuation of recent low inflows	1,445 GL	28 GL	1,139 GL	56 GL	34 GL
<i>Difference (%)</i>	<i>-252 GL (-15%)</i>	<i>-3 GL (-10%)</i>	<i>-499 GL (-30%)</i>	<i>-54 GL (-49%)</i>	<i>-68 GL (-67%)</i>
Environmental water⁶					
Long-term average ⁴	4,089 GL	184 GL	1,591 GL	162 GL	109 GL
Continuation of recent low inflows	2,005 GL	55 GL	489 GL	23 GL	17 GL
<i>Difference (%)</i>	<i>-2,084 GL (-51%)</i>	<i>-129 GL (-70%)</i>	<i>-1,102 GL (-69%)</i>	<i>-139 GL (-86%)</i>	<i>-92 GL (-84%)</i>

Notes:

1. Total inflows include diversions for consumptive use, environmental water, plus system operating water. Excludes water use in unregulated systems and small catchment dams.

2. Murray diversions and inflows are Victorian shares only. Murray environmental water is Victorian flow at the South Australian border (including Living Murray Initiative commitments).

3. Campaspe diversions include Coliban River diversions for urban and irrigation supplies.

4. Calculated based on historic record July 1890-June 2007.

5. These percentages may vary from Table 2.1 which outlines the change from the pre-July 1997 long-term average (while this table outlines the change from the long-term average over the full historic record, including July 1997-June 2007).

6. Environmental water is reflected by end of valley flows (ie. flows at the basin outlet).

Summary of Scenario D – continuation of recent low inflows

- Overall water availability (total inflows) could be reduced by 42 per cent in the Murray system and 72 per cent in the Loddon.
- Water availability for consumptive use (diversions) could be reduced by 10 per cent in the Broken and 67 per cent in the Loddon.
- Water availability for the environment (environmental water) could be reduced by 51 per cent in the Murray and 86 per cent in the Campaspe.

Why is there a disproportionate impact on water availability for the environment compared with consumptive use?

Climate change means environmental flows will be reduced significantly more than water for users. This is because the majority of environmental flows are not provided by entitlements; they come from unregulated flows or 'above cap' water that cannot be harvested or spills from storages. Spills from storages are particularly reduced under climate change because storages on average hold less water in them and can therefore capture a greater proportion of inflows.

The environment does have some entitlements (see Appendix 4). While these are less impacted by climate change (see Tables 2.4 and 2.5), they represent less than six per cent of the total water available for the environment.

2.5 Water availability for entitlement-holders

2.5.1 Water share-holders

A water share is a legally recognised, secure share of the water available to be taken from a water system, (see page 10) and may be high-reliability or low-reliability. Reduced inflows mean less water available for seasonal allocations to water shares, expressed as a percentage of the entitlement volume.

High-reliability water shares total 2,288 GL in northern Victoria¹⁹. Table 2.4 outlines the change in allocations for high-reliability water shares under Scenarios B and D compared to the base case assuming no action is taken.

In the Murray system, full allocations for high-reliability water shares are expected in 68 years out of 100 under Scenario D, compared to the base case of 98 years out of 100. The number of years with zero allocations could increase from none to five out of 100. In the Goulburn system full allocations of high-reliability water shares would decrease from 96 to 28 years out of 100 under Scenario D and zero allocations could be experienced one year in every hundred.

More detailed modelling results can be found in Background Report 2.

Table 2.4 Forecast reliability of high-reliability water shares in the major regulated systems of the Northern Region²⁰

Indicator		Scenarios		
		BASE CASE: Long-term average	SCENARIO B: Medium climate change at 2055	SCENARIO D: Continuation of low inflows (July 1997 - June 2007)
Murray	No. of years with 100% allocations	98 out of 100	89 out of 100	68 out of 100
	Lowest allocation	71%	0%	0%
	No. of years with 0% allocations	0 out of 100	2 out of 100	5 out of 100
Broken ¹	No. of years with 100% allocations	89 out of 100	79 out of 100	58 out of 100
	Lowest allocation	0%	0%	0%
	No. of years with 0% allocations	1 out of 100	1 out of 100	5 out of 100
Goulburn	No. of years with 100% allocations	96 out of 100	79 out of 100	28 out of 100
	Lowest allocation	27%	0%	0%
	No. of years with 0% allocations	0 out of 100	1 out of 100	1 out of 100
Campaspe ²	No. of years with 100% allocations	97 out of 100	89 out of 100	34 out of 100
	Lowest allocation	0%	0%	0%
	No. of years with 0% allocations	1 out of 100	1 out of 100	5 out of 100
Loddon ²	No. of years with 100% allocations	94 out of 100	79 out of 100	26 out of 100
	Lowest allocation	0%	0%	0%
	No. of years with 0% allocations	1 out of 100	3 out of 100	11 out of 100

Notes:

1. The base case estimate of 89 years out of 100 is less than that used to calculate the Mokoan decommissioning (91 years out of 100) as this model includes the 2005/06 and 2006/07 water years which occurred after the decision to decommission Mokoan.
2. These numbers differ from those presented in the Draft Strategy as the models were recalibrated to improve estimates of system operating water requirements.

Table 2.5 outlines the change in allocations for low-reliability water shares under Scenarios B and D (assuming no action is taken) compared to the base case.

Low-reliability water shares in northern Victoria total 772 GL²¹. With reduced water availability, low-reliability water shares will be more affected than high-reliability water shares.

In the Murray system, the number of years with full allocations for low-reliability water shares would not change but the number of years with zero allocations would increase from 14 out of 100 under the base case to 72 years out of 100 under Scenario D.

In the Goulburn system, full allocations for low-reliability water shares would never occur under Scenario D, compared to the base case of nine years out of 100. The number of years with zero allocations would increase from 23 years to 96 years out of 100 under Scenario D.

More detailed modelling results can be found in Background Report 2.

Table 2.5 Forecast reliability of low-reliability water shares in the major regulated systems of the Northern Region²²

Indicator		Scenarios		
		BASE CASE: Long-term average	SCENARIO B: Medium climate change at 2055	SCENARIO D: Continuation of recent low inflows (July 1997- June 2007)
Murray	No. of years with 100% allocations ³	<10 out of 100	<10 out of 100	<10 out of 100
	Lowest allocation	0%	0%	0%
	No. of years with 0% allocations	14 out of 100	45 out of 100	72 out of 100
Broken	No. of years with 100% allocations	85 out of 100	70 out of 100	49 out of 100
	Lowest allocation	0%	0%	0%
	No. of years with 0% allocations	10 out of 100	20 out of 100	41 out of 100
Goulburn	No. of years with 100% allocations	8 out of 100	1 out of 100	0 out of 100
	Lowest allocation	0%	0%	0%
	No. of years with 0% allocations	23 out of 100	70 out of 100	96 out of 100
Campaspe ¹	No. of years with 100% allocations	78 out of 100	61 out of 100	3 out of 100
	Lowest allocation	0%	0%	0%
	No. of years with 0% allocations	8 out of 100	20 out of 100	89 out of 100
Loddon ¹	No. of years with 100% allocations	9 out of 100	1 out of 100	0 out of 100
	Lowest allocation	0%	0%	0%
	No. of years with 0% allocations	24 out of 100	70 out of 100	96 out of 100

Notes:

1. These numbers differ from those presented in the Draft Strategy as the models were recalibrated to improve estimates of system operating water requirements.

2.5.2 Licence-holders on unregulated rivers

Unregulated river systems do not have large dams or weirs to regulate flow. While unregulated rivers represent 90 per cent of river length in northern Victoria, they account for less than 10 per cent of its surface water use.

It is difficult to quantify the impact of climate change on unregulated users as effects are system-specific or localised. However in general, impacts could include an increase in the proportion of time licence-holders spend on restrictions or bans and therefore a reduction in reliability.

To better understand the impact of climate change on unregulated systems, modelling has been undertaken for a number of systems including the upper Ovens River. The Ovens system is the largest unregulated system in northern Victoria. Below Myrtleford, the system becomes part-regulated as the reliability of supply is also influenced by regulated tributaries. Climate change could reduce inflows in the Ovens system by between six and 33 per cent (refer to Table 2.1).

Generally, each unregulated river system is managed to a set of rules or a management plan where restrictions and bans on extractions are put in place to protect minimum flows. Projections indicate that for the upper Ovens River, the total time spent on Level 1, 2 and 3 restrictions increases from six per cent under the base case up to nine per cent under Scenario D. The time spent on bans is doubled from 0.3 to 0.6 per cent of weeks, assuming current levels of use. The increase occurs mainly during summer, with little change in winter restrictions (see Background Report 4).

Initial modelling for the Buffalo River (Ovens system) and the Big River (Goulburn system)²³ has been undertaken to better understand the magnitude of impacts for these two unregulated systems. It shows that under Scenario D, licence-holders within the Big River system would be expected to receive their total winter-fill licence volume 64 per cent of the time, compared to 80 per cent under base case. Overall, mean annual diversions could be reduced by around five per cent (see Table 2.6).

Table 2.6 Forecast reduction in mean annual diversions in the Big River and Buffalo River systems due to climate change²⁴

System		Base case	Scenario B	Scenario D
		BASE CASE: Long-term average	SCENARIO B: Medium climate change at 2055	SCENARIO D: Continuation of low inflows (July 1997 - June 2007)
Big River	Mean winter-fill streamflow volume (GL) ¹	129.1	104.9	102.2
	Mean volume diverted (GL)	18.6	17.7 (-5.1%)	17.6 (-5.5%)
	Reliability ²	80%	68%	64%
Buffalo River	Mean winter-fill streamflow volume (GL) ¹	112.3	85.7	73.2
	Mean volume diverted (GL)	20.8	19.8 (-7.7%)	19.5 (-9.1%)
	Reliability ²	77%	72%	70%

Notes:

1. Only winter-fill volume is shown as unregulated diversions are limited to the winter months in most cases.

2. Reliability of supply is the percentage of years consumptive users are expected to receive their Section 51 licence volume having complied with the winter-fill period described by the SDL.

2.5.3 Groundwater licence-holders

Future groundwater availability is dependent on both the existing stores within aquifers and the level of recharge resulting from rainfall infiltration. The CSIRO Sustainable Yields Project²⁵ concludes that groundwater recharge rates could decline by as much as 30 per cent in the southern Murray-Darling Basin. The report states that “the impact of 2030 climate conditions on rainfall recharge and groundwater levels would be minor compared to the impacts resulting from current and additional future extraction²⁶.” This is because many aquifers have considerable storage volumes and therefore a reduction in recharge will not dry up the resource in the short term. However, to protect the resource over time, the impacts of reduced recharge and ongoing extraction on groundwater levels needs to be managed (see page 69).

It has been predicted that climate change will have little impact on the rate of surface and groundwater interaction and there will be no net impact across the Basin²⁷.

Ongoing depletion of existing groundwater supplies as a result of current and future extraction could reduce groundwater access and potentially quality. In turn, this may result in increased costs for infrastructure, including pump replacement, bore deepening or replacement and groundwater desalination.

Further information regarding the impact of climate change on groundwater systems in northern Victoria can be found at www.csiro.au/partnerships/MDBSY.html.

2.5.4 Urban entitlements

With reduced water availability, urban water corporations’ surface and groundwater entitlements are less reliable. Under climate change scenarios, urban water users could expect to experience more frequent, extended and severe water restrictions. There is also the potential for increased demand due to population growth, which could place additional pressure on water for households and industry in the future. *Victoria in Future 2008* forecasts that the Northern Region’s current population of 529,000 will increase to about 781,000 by 2056²⁸. Average annual population increases to 2031 will chiefly be due to growth in larger urban centres, such as Bendigo, Wodonga, Echuca, Yarrawonga, Cobram, Wangaratta, Shepparton and Mildura.

The potential impact of climate change on urban systems was modelled through urban water corporations’ water supply demand strategies in 2007 and is summarised in Appendix 7. Actions are now being implemented to address long-term urban water supply deficits. As a result, Northern Region water corporations are well placed to manage the impact of climate change on towns and to secure water for future growth. See Chapter 8 for further information.



Bush shower, Owens River

Photographer: Bruce Cumming

2.6 Water availability for the environment

The changing climate means there will be more frequent and extended droughts, with longer dry spells and less frequent floods. The result will be less water for rivers and wetlands (see pages 23 and 24). If not addressed, the ecological impacts of a significant reduction in environmental flows could include:

- the disappearance of most areas of river red gum forest, including the River Murray icon sites
- a likely end to colonial bird breeding, such as egrets
- a significant decline in populations of golden perch, Murray cod and other native fish
- the degradation and potential loss of internationally recognised Ramsar-listed wetlands, such as the Kerang Lakes.

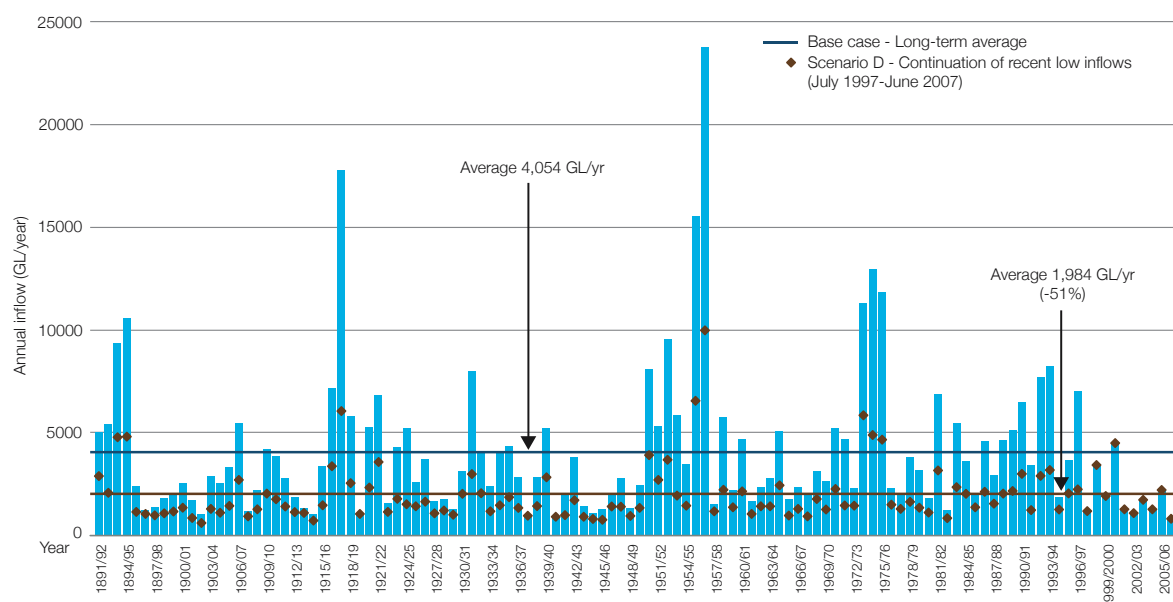
2.6.1 Regulated river systems

Currently, six per cent of the environmental water reserve (EWR) is made up of entitlements with similar characteristics to those held by irrigators (that is, tradeable and a mix of high and low-reliability). Over time, the environment is expected to hold a larger proportion of entitlements (see page 45). These entitlements will experience the same impacts as those of water share-holders that were noted previously in Tables 2.4 and 2.5 (see page 25 and 26). The remaining environmental water is provided as passing flows and above cap water and is more susceptible to the impact of climate change due to a reduced frequency and magnitude of spills from storages, and reduced flows from unregulated rivers.

Tables 2.2 and 2.3 (see page 23 and 24) show that environmental water in the Murray system would be reduced by 28 per cent under Scenario B (medium climate change) and by 51 per cent under Scenario D (a continuation of recent low inflows). Figure 2.8 illustrates the annual change in environmental water in the Murray system under the more severe scenario.

See Background Report 3 for information on the future availability of environmental water in the region's other regulated river systems.

Figure 2.8 Forecast annual availability of environmental water in the Murray system (Scenario D average compared with the long-term average)²⁹



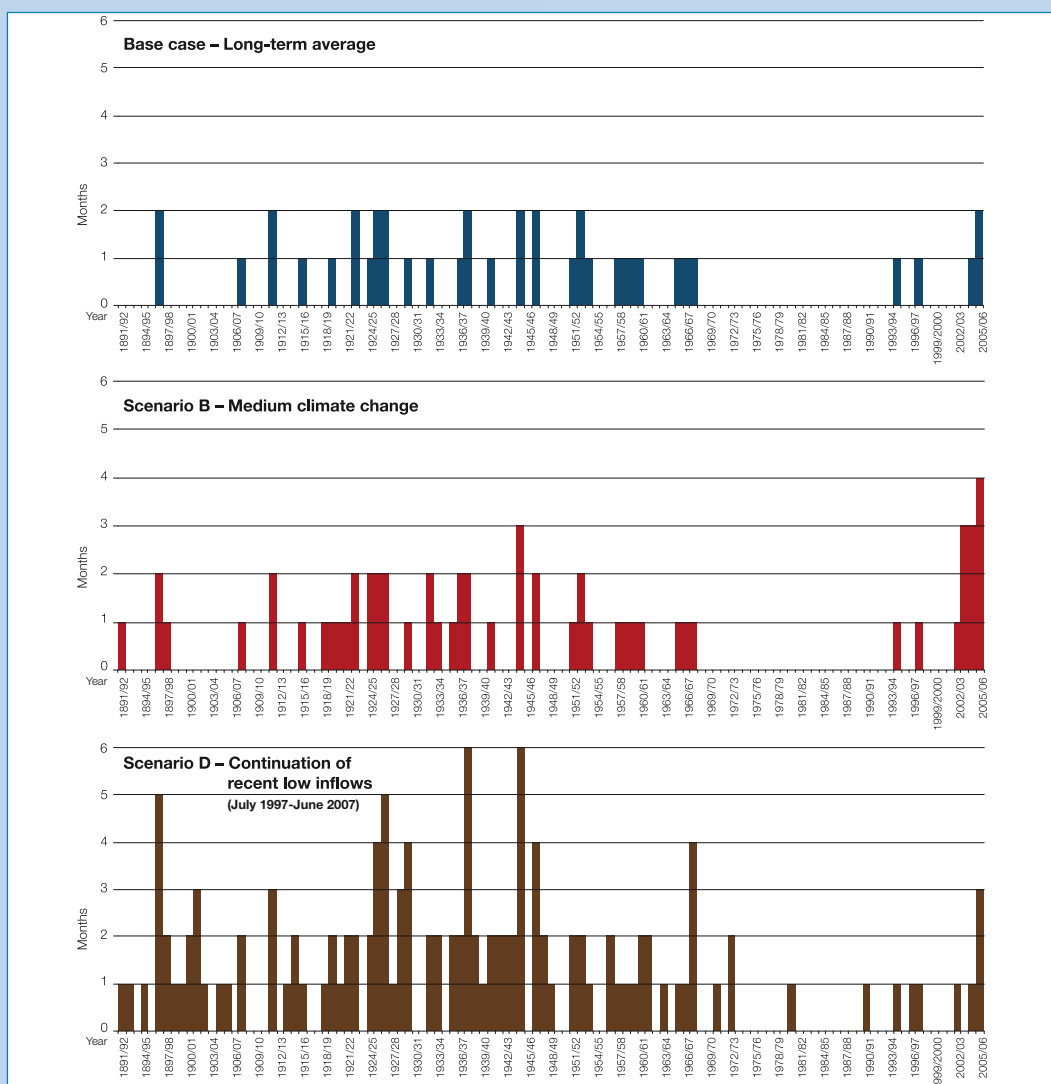
Case study: Campaspe River environmental flows

Environmental flows in the Campaspe River help to maintain water quality, support flora and fauna and protect public health and safety. The community values the river for its healthy native vegetation and wildlife, scenic qualities and as a place of recreation. A scientific environmental flow study in the river established the various flow components required to protect its key environmental values³⁰.

One of these flow components is a minimum river flow of 10 ML/day for six months in summer/autumn to provide adequate habitat for fish. Flows below this mean that native fish will continually be in contact with very high salinity levels in the lower Campaspe. One or more months in contact with highly saline water is likely to mean native fish will not survive.

Modelling has been undertaken to determine the ability to provide this flow, assuming no intervention, with long-term average climate conditions (base case), medium climate change (Scenario B) and a continuation of recent low inflows (Scenario D). Figure 2.9 shows that in all scenarios there are many occasions where the flows are less than the required minimum for more than one month. This means that native fish objectives are not likely to be met. Neither do other flow components, such as low flow freshes and low flows in winter for fish passage, meet the recommendations under the climate change scenarios. The ecological impact of this could be declining water quality, pools silting up and loss of native vegetation. Under these conditions, it is highly unlikely the river will support natural populations of native fish such as Murray cod.

Figure 2.9 Forecast number of months where recommended flows of 10 ML/day are not met in the Campaspe River - base case (blue), Scenario B (red) and Scenario D (brown)



Associated floodplains and wetlands

There are more than 400 high-value wetlands in 30 wetland systems in the Northern Region (see Appendix 6). These range from large areas of floodplain, such as the Barmah and Gunbower Forests, to small wetlands on farms and public land. They include floodplain wetlands on the River Murray (including the Living Murray icon sites) and Victoria's tributaries, and those associated with irrigation distribution systems.

Wetlands will be affected by reduced water availability in three ways:

1. Reduced allocations to environmental entitlements will mean there is less water available for watering events, such as for the Barmah Forest.
2. Less water will be supplied to the irrigation distribution system, resulting in less water delivered to and via irrigation system wetlands.
3. The frequency and magnitude of unregulated flows and spills from storages are likely to be reduced as a greater proportion of flows are captured in storage. This will reduce the frequency and duration of overbank flows during natural flooding events.

The expected reductions in water availability mean that wetlands will be watered less frequently. If watering events are too far apart the plants and animals associated with these floodplains may not be able to survive. These plants and animals have various ways of surviving dry periods (such as dormant seeds or eggs and in the case of some frogs, burrowing below the surface), but the time period that they can survive is limited. This is known as a 'dry spell tolerance'.

A reduction in flooding events will mean a loss of connectivity between rivers and their floodplains, with reduced carbon and nutrient exchange. Failure to support adequate flooding regimes could result in:

- the loss of endemic floodplain vegetation, particularly flood-dependant species such as river red gums
- a significant reduction in the biodiversity of river valleys, notably birds, bats, frogs and insects
- reduced productivity in river ecosystems, particularly in food resources for immature and adult native fish.

Many wetlands are dependent on irrigation distribution systems for the delivery of water from an environmental entitlement. Water requirements for these ecosystems will be met in 80 years out of 100 under the base case, decreasing to 38 years out of 100 under Scenario D (see Background Report 8). The impact on ecosystem values in these wetlands will depend on how water distribution is prioritised between different wetlands.

There are many other wetlands associated with the irrigation distribution system that currently cannot receive water from this environmental entitlement due to a lack of delivery infrastructure. Without intervention, the condition of these wetlands will continue to decline. See page 147 to see how environmental priorities will be set to maximise the benefits of the available water, and page 133 for how targets will be set to recover water for these wetlands.



Swans, Lindsay Island

Photographer: Mallee Catchment Management Authority

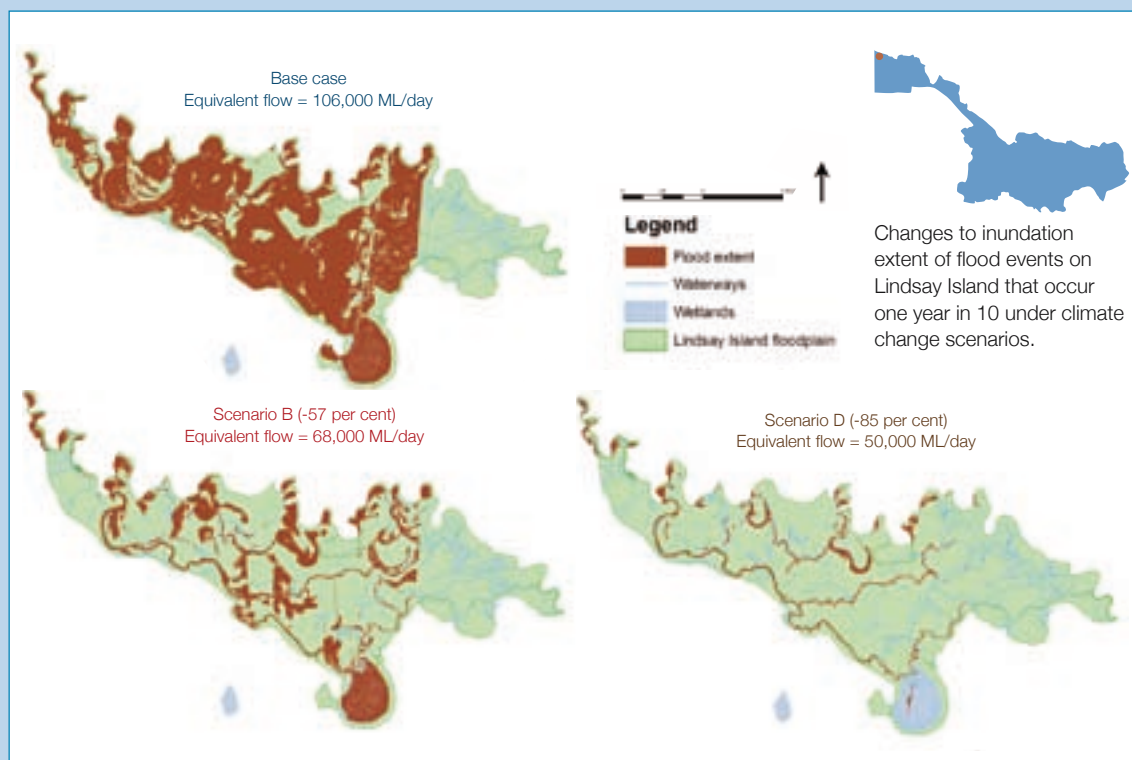
Case study: Change in viable floodplain at Lindsay Island

Lindsay Island is a 17,000-hectare floodplain on the River Murray, just before the South Australian border. Much of the floodplain vegetation is already stressed because of less flooding caused by river regulation and ongoing dry conditions. Only 20 per cent of river red gums were considered to be in good condition when assessed in 2006. Without intervention, the area that receives sufficient flooding to support viable floodplain communities will be further reduced with climate change.

The area flooded every five years (frequently enough to support river red gums and wetlands) will drop by 72 per cent, from 6,000 hectares under the base case to 1,700 hectares under Scenario D. This will greatly reduce the habitat available for native fish, frogs, tortoises and birds as well as river red gums and other flood-dependent vegetation. Several threatened species in this area of the River Murray may not survive this additional pressure, including the nationally-threatened growling grass frog, painted snipe and regent parrot (which nests in large river red gums).

Without intervention the area flooded every 10 years (frequently enough to sustain blackbox and lignum) would drop by 85 per cent, from 14,000 hectares under the base case to 2,210 hectares under Scenario D (see Figure 2.10). A reduction in the area of lignum would impact on breeding and feeding opportunities for waterfowl including threatened freckled, blue billed and pink-eared ducks. Any future breeding events would be much smaller and less frequent, putting these threatened species at increased risk. Figure 2.10 demonstrates the dramatic reduction in floodplain under medium climate change (Scenario B) or a continuation of the recent low inflows (Scenario D).

Figure 2.10 Forecast change to area of floodplain at Lindsay Island for a one-in-10 year flood event (Scenarios B and D compared with the long-term average)³¹



2.6.2 Unregulated river systems

Under climate change, there will be a greater number of years where flows are insufficient to maintain key environmental values. Under Scenario D, average summer flows in the Ovens system will be reduced by 29 per cent and average winter flows by 27 per cent (see Table 2.7). Increased periods of low flows may result in:

- disconnected pools of water, affecting movement of fish and macroinvertebrates
- reduced water quality as a result of increased water temperatures, fewer flushing flows and loss of connectivity
- reduced diversity of in-stream habitat.

2.6.3 Groundwater-dependent ecosystems

Groundwater-dependent ecosystems are those that rely on groundwater for all or part of their overall water needs. These are generally located where groundwater discharges to the surface, including rivers, wetlands and in some instances terrestrial vegetation. Currently, little is known about the extent and distribution of groundwater-dependent ecosystems across northern Victoria.

When groundwater and surface water interaction is high, rivers or river reaches in the Northern Region may rely on groundwater discharge to maintain baseflows. However, the extent of this contribution is highly variable and dependent on local hydrogeological conditions. Floods provide overbank flows and also replenish groundwater reserves. Often groundwater is very important to maintain floodplain vegetation between floods.

In the Goulburn Broken system, increased use of groundwater due to lower surface water availability is expected to reduce streamflows by 20 GL per year by 2010. This represents about 0.6 per cent of the average surface water availability under historical climate patterns. By 2030, groundwater use is expected to reduce streamflows by 37 GL per year or 1.3 per cent of average availability³². The significance of these reductions is magnified in the summer and autumn, when groundwater baseflows may make up a greater proportion of the total flow in a river or river reach.

Wetlands that depend on water from local run-off after rain or from groundwater often experience periodic drying under natural conditions and when flooded, provide breeding and feeding habitat for birds including brolgas, Latham's snipe, craiks and rails and a large range of frogs. Many of these wetlands are on private land and can be damaged by grazing and cropping. Damage to these wetlands reduces habitat for waterbird breeding, especially brolgas.

While some wetlands are entirely dependent on groundwater, others are only partially dependent, usually during droughts. In some cases, groundwater may no longer be available to these ecosystems. The protection of these environmental assets needs an integrated approach that incorporates watering regimes and land management activities.

Table 2.7 Forecast availability of annual, summer and winter streamflow in the Ovens system (Scenario B and D averages compared with the long-term average)³³

Location	Period	Base case - long-term average	Scenario B - medium climate change at 2055		Scenario D - continuation of recent low inflows (July 1997-June 2007)	
		Mean flow (GL)	Mean flow (GL)	Change from base case (GL, %)	Mean flow (GL)	Change from base case (GL, %)
Ovens River at Bright	Annual	202	153	- 50 (-24%)	146	-56 (-28%)
	Summer (Nov-Apr)	37	28	-9 (-25%)	27	-22 (-29%)
	Winter (May-Oct)	165	125	-40 (-24%)	120	-45 (-27%)

2.7 Threats to water quality

Water quality is as important as quantity. Poor water quality has major consequences for the health of people, livestock, rivers, wetlands and aquifers. This includes rising salinity, increasing sediment and nutrient loads, changing pH and temperature level and reduced dissolved oxygen. Water quality issues (for example, blue green algal blooms) may cause short-term water shortages.

Water quality issues are typically caused by run-off from farmland and groundwater discharged from salt-affected areas. Management of these land-based water quality issues requires long-term improvements of land management practices.

New issues are emerging due to ongoing dry conditions, such as the exposure of acid sulphate sediments. Water quality issues are variable over time and space. For example, drought or climate change reduces discharge to streams, but increases the likelihood of other water quality problems stemming from acid sulphate soils and bushfires. Victoria will continue to take a proactive approach to the management of water quality issues, and there will be continuous improvement as new threats to water quality arise.



Salinity

Photographer: Arthur Mostead, MDBA

2.7.1 Salinity

Salinity is the most prevalent water quality problem in the Northern Region.

Substantial reserves of salt are stored in the soils of northern Victoria. As groundwater levels have risen over time (due to clearing of native vegetation and irrigation), saline groundwater discharges to streams have increased and salt that has accumulated on the surface through evaporation is washed into streams.

Salt has serious implications for water quality, plant growth, biodiversity, land productivity and infrastructure. It affects farmlands, floodplains and river water quality, which in turn affects consumptive use downstream. About 260,000 hectares of Victoria's farmland is suffering significant damage from soil salting. Of this, 140,000 hectares or 54 per cent is located in Victoria's northern irrigation districts. 120,000 hectares of non-irrigated (dryland) grazing and cropping land throughout the state is also affected³⁴.

There are two main strategies to manage salinity levels:

1. Limiting the mobilisation of salts stored in the soil profile by controlling the rise in groundwater levels. Groundwater levels can be controlled by reducing recharge (for example, by establishing deep-rooted vegetation, improved surface drainage and more efficient irrigation). Alternatively groundwater pumping or tile drains that remove groundwater can be used to lower groundwater levels.
2. Limiting the impact of salinity, for example, by using salt interception schemes that capture saline water before it runs into streams and then disposing of the salt in evaporation basins.

As the climate becomes drier, salt will be stored more frequently within the landscape or floodplain, rather than mobilised within waterways. This salt may be remobilised into the river system if watering occurs. Improved management of salinity is discussed further on page 124.

2.7.2 Pollution events

Pollution events can often occur in periods of high temperature and low flows (for example, during droughts). Examples include:

- blue-green algal blooms (as occurred in the River Murray in April 2009)
- fish kills resulting from reduced dissolved oxygen levels (referred to as 'blackwater events')
- salt slugs resulting from increased run-off from saline soils in a small reach of river (this is typical in some areas after thunderstorms)
- sediment slugs following run-off in bushfire-affected areas.

See page 143 for more information on management of these events.

2.7.3 Acid sulphate soils

Acid sulphate soils are soils that contain sulphuric acid or have the potential to form sulphuric acid when exposed to oxygen (for example, through drying or disturbance)³⁵.

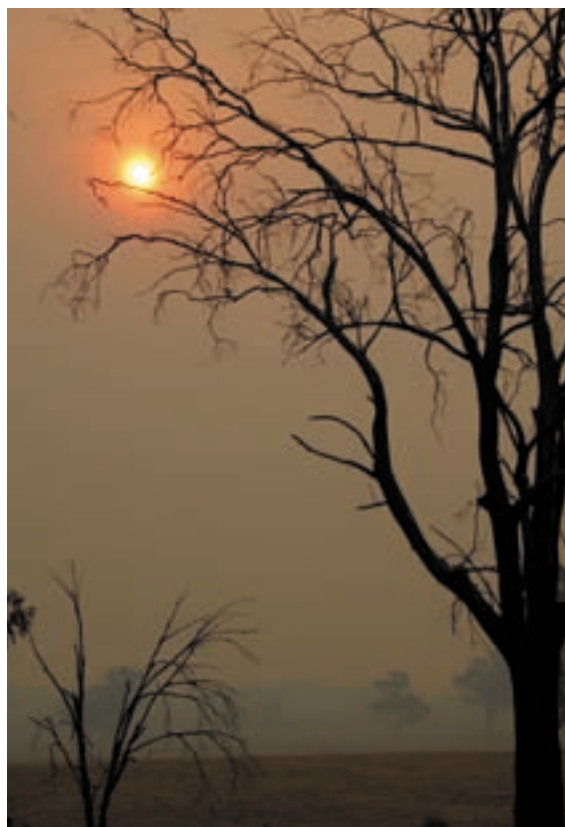
Record low inflows and river levels in recent years have led to the drying of many wetlands in south-east Australia, resulting in the exposure of acid sulphate soils. Acidification of several wetlands has been reported in the last 12 months. Sites at high risk are those that have been permanently inundated and have a strong connection to highly saline groundwater.

Rewetting from rising river levels or rainfall may lead to acidification of wetlands and creeks, with pH dropping as low as one. Other risks associated with acid sulphate soils include mobilisation of metals, deoxygenation of the water column and production of toxic gases. These risks can lead to irreversible damage to the environment and impacts on water supplies. See page 144 for information about how these risks are being addressed.

2.7.4 Bushfire

Bushfires can have a direct impact on water quality. Quality is often threatened immediately after a fire as rain washes ash, charcoal, nutrients and other materials into rivers and wetlands, causing increased turbidity and changes to local stream ecology. The impacts on water quality are often difficult to predict and may be locally variable, as they will depend on the severity of the bushfire and the degree of vegetation recovery, terrain and type of rainfall event. As such, water corporations and catchment management authorities manage water quality risks on a case-by-case basis.

Following the 2003 bushfires, which burnt more than 500,000 hectares of forest and grazing land in the Northern Region, a major study was commissioned to assess the likely impacts of the fires on water quality and quantity. As part of this study, an extensive network of short-term water quality monitoring sites was set up to assess impacts and any possible recovery. A number of detailed reports were produced, and are available from www.mdbc.gov.au. The results and methods will be used to inform further investigations undertaken by the Murray-Darling Basin Risks to Shared Water Resources Program³⁶.



Smoke haze

Photographer: Bruce Cumming

2.8 Where to from here?

There are many factors that will influence future water availability and quality in the Northern Region, including climate change and variability, water extraction and interception activities. Regardless of the scenario that occurs, in the future there is likely to be less water of acceptable quality available for human consumption and the environment. Users on regulated systems will be faced with lower allocations, while unregulated systems will experience bans and restrictions more often. There may be less recharge to groundwater systems and increased demands. Environmental flows will be impacted to an even greater extent. It is clear that our current water use practices are no longer sustainable and will have to change.

With the Murray-Darling Basin Cap in place, Victoria is not permitted to divert more water in the region and analysis shows that new or enlarged storages are not an effective solution (see Appendix 5 and Background Report 10). A large-scale desalination plant is not an option, due to its significant cost and a lack of sufficient seawater. Water savings from modernisation projects provide a critical source of water that can go to consumptive use or the environment, but they may be insufficient to completely address the reduction caused by climate change. As a result, the remaining chapters of this Strategy focus on improving the way existing water resources are managed and used. They aim to maintain key agricultural, environmental and urban values in a future of reduced water availability.

In addition, Victoria (through the South Eastern Australian Climate Initiative and other projects) is investing in improving climate and streamflow forecasts that look forward three to 12 months. This has the potential to improve the management of rural and urban supplies to cope with short to medium-term variability in resource availability.



Chinaman's Bridge, Goulburn River

Photographer: Bruce Cumming



3

This chapter outlines Victoria's support for the Commonwealth's aim of protecting key environmental values in the Basin. This needs to be achieved while also protecting existing entitlements.



Sharing water resources in the Murray-Darling Basin

Guide to the chapter

Section 3.1 Introduction

- A history of Basin management
- Challenges for the Basin

Section 3.2 Implementation of Commonwealth water programs

- The Basin Plan
- The Commonwealth's \$3.1 billion water purchase

Section 3.3 Reforming the *Murray-Darling Basin Agreement*

- Ensuring river operation during droughts
- Clarifying storage rights
- Improving water accounting

Section 3.4 Powers, institutions, roles and responsibilities

- Clarifying accountabilities
- Coordinated management of environmental entitlements

What is the issue with existing arrangements?

The Commonwealth Government will approve new limits on how much water can be taken from the Basin's river and groundwater systems. These limits are expected to reduce the amount of water available for consumptive use and increase allocations to the environment. They could reduce the volume and reliability of water entitlements. It is unclear how the new balance between consumptive use and the environment will be set, what the social and economic consequences will be and how these are to be managed. The Commonwealth may now make decisions alone, where previously decisions were made jointly by all the Basin states and the Commonwealth. It is unclear how the interests of the states and regional communities will be incorporated into the Commonwealth's decision making. Roles and responsibilities need to be clarified to incorporate the new Commonwealth powers created by the *Water Act 2007*.

What improvements does the Strategy make?

- Identifies critical elements for the Murray-Darling Basin Authority to undertake in the development of the Basin Plan, including protection of existing water entitlements, thorough community engagement and consideration of the implications of climate change.
- Highlights opportunities for improved community outcomes by integrating state and Commonwealth programs, including modernisation, water purchase and structural works.
- Outlines areas of unclear accountability, together with a preferred way forward – at the heart of this is the principle that where decisions can be made effectively at a local level, this should be the case.

3.1 Introduction

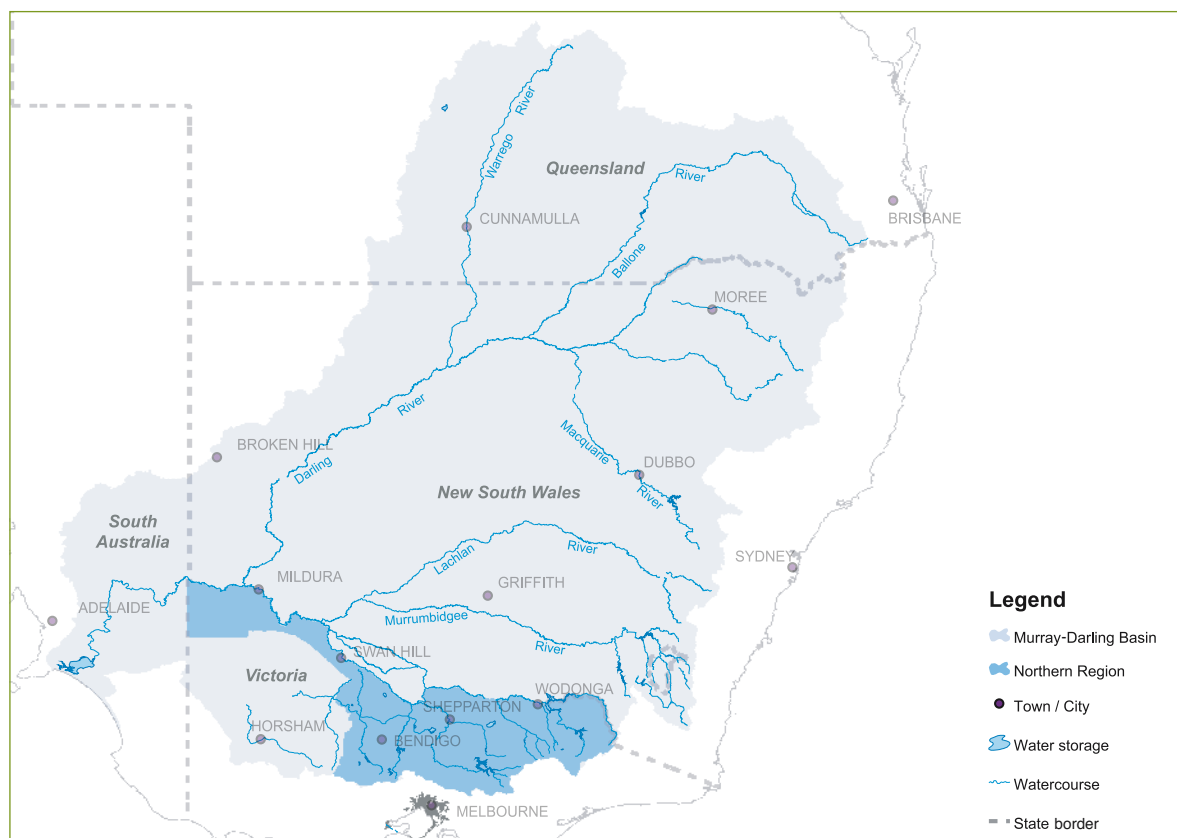
The Murray-Darling Basin extends from north of Roma in Queensland to Goolwa in South Australia and covers three quarters of New South Wales and half of Victoria (see Figure 3.1). It generates about 40 per cent of the nation's agricultural income³⁷ and provides a vital source of fresh water for domestic consumption and industrial use. Victoria's share of Murray-Darling Basin water resources support large areas of irrigation in the Northern Region and this water is a key factor in the region's social fabric and ongoing prosperity.

3.1.1 A history of Basin management

Spanning four states and a territory, the Murray-Darling Basin requires a unique approach to managing its water resources. For many years the 1915 *River Murray Waters Agreement* and then the 1987 *Murray-Darling Basin Agreement* provided the mechanism for cooperation between the Commonwealth, Victorian, New South Wales, and South Australian Governments. More recently, Queensland and the Australian Capital Territory joined the 1987 Agreement as signatories.

The 1987 Agreement established the Murray-Darling Basin Ministerial Council and the Murray-Darling Basin Commission. The purpose of the Council was to promote and coordinate effective planning and management for the equitable, efficient and sustainable use of the water, land and other environmental resources of the Murray-Darling Basin. Decisions made by the Ministerial Council and the Commission had to be unanimous. The Agreement set out detailed water-sharing arrangements and management of state actions that affect the quantity and quality of the shared resources of the River Murray.

Figure 3.1 The Murray-Darling Basin



In response to environmental impacts of the recent climate and levels of water use, the Commonwealth Government is now taking a greater role in Basin water management. In late 2007 it passed the *Water Act 2007*, which was further amended in late 2008 to reflect the agreements reached between Basin governments through the July 2008 intergovernmental *Agreement on Murray-Darling Basin Reform*. As a result, the Commonwealth now has greater decision-making powers and responsibilities in Basin water resource management.

The primary objective of the *Water Act 2007* is to enable the Commonwealth, in conjunction with Basin States, to manage the Basin's water resources in the national interest*. Other objectives include to: return over-allocated or over-used water resources to environmentally sustainable levels of extraction; improve water security for all users of Basin water resources; and promote the use and management of the Basin water resources in a way that optimises economic, social and environmental outcomes.

A key element of the Commonwealth's Act is the establishment of a new independent Murray-Darling Basin Authority. The Authority is responsible for preparing a Basin Plan by 2011 for the integrated management of Basin water resources, which will be approved by the Commonwealth minister

administering the Act. The Victorian Government has negotiated that the Basin Plan will not come into effect before 2019 to provide certainty for Victorian farmers and communities during the transition period. See page 42 for further discussion of the Commonwealth's Basin Plan.

The *Murray-Darling Basin Agreement* has also been further revised and the functions of the Murray-Darling Basin Commission have been split between a new Murray-Darling Basin Ministerial Council, a Basin Officials Committee and the Murray-Darling Basin Authority. The Ministerial Council now decides changes to the Agreement, including to state water-sharing arrangements. The Basin Officials Committee advises the Ministerial Council on these changes and sets target outcomes for river operations. The Authority plans and manages river operations to deliver on these outcomes and undertakes other activities as directed by the Ministerial Council. Separately, the Authority prepares the Basin Plan for the Commonwealth Minister for Water.

Figure 3.2 shows the range of governments and authorities with responsibilities in Basin water resource management. These arrangements provide scope for considerable uncertainty but also many opportunities to work together to achieve joint outcomes. See page 49 for further discussion of these opportunities.

Figure 3.2 Key responsibilities and planning processes under the Commonwealth *Water Act 2007*

Murray-Darling Basin Agreement		Water Act 2007	
Murray-Darling Basin Ministerial Council		Commonwealth Minister for Water	
Decides changes to state water sharing		Approves Basin Plan	
<ul style="list-style-type: none"> Agrees amendments to the Agreement Directs Basin Officials Committee and Murray-Darling Basin Authority on river operations Consulted on Basin Plan 		<ul style="list-style-type: none"> Directs Murray-Darling Basin Authority in preparing Basin Plan Accredits state water resource plans Responsibility for \$12.9 billion Water for the Future initiative 	
Basin Officials Committee	Murray-Darling Basin Authority		Commonwealth Environmental Water Holder
Decides river operation outcomes	Operates River Murray	Prepares Basin Plan	Manages Commonwealth environmental water holdings
<ul style="list-style-type: none"> Sets river operation objectives for Authority Advises Ministerial Council on state water-sharing 	<ul style="list-style-type: none"> Delivers state water Operational planning for water delivery Operates and maintains water supply and salt mitigation assets 	<ul style="list-style-type: none"> Sets sustainable diversion limits Outlines environmental watering plan Sets water quality and salinity targets Sets water trading rules Monitors state compliance 	<ul style="list-style-type: none"> Manages Commonwealth environmental water holdings (including use and trade) consistent with the Basin Plan

Footnote:

* The *Water Act 2007* does not define the national interest. Generally accepted criteria for determining the national interest include where there:

- are spill-over effects (eg. in the Murray-Darling Basin)
- are equity or common interest issues (eg. with social welfare support and defence)
- is a need for uniformity because a diversity of rules creates inefficiency (eg. with climate change)
- are significant or difficult issues (eg. with aboriginal health)
- are policy inter-relationships (eg. with education/training/economic performance)³⁸.



Sultanas, Irymple

Photographer: Bob Marlin, Mallee Catchment Management Authority

3.1.2 Challenges for the Basin

The challenges of water resource management in the Murray-Darling Basin have never been starker than in recent years. An unprecedented sequence of dry years included record low inflows in 2006/07. Extraordinary contingency measures were required to run the River Murray at the start of the 2009/10 season. Water carting may be required to supply some towns and some domestic and stock needs. Low allocations throughout the Basin have severely affected irrigators, with some systems not receiving any allocation at all in the worst year. Many farmers have ceased irrigating, with potentially adverse flow-on impacts to their local communities. There has been an even greater reduction in the amount of water available to the environment that, among other things, has resulted in almost no breeding of colonial water birds and river red gum deaths in some areas. Tourism, recreational and cultural uses of water have all been significantly affected.

The drier climate of the past 12 years has focused community attention on the key challenge in the Murray-Darling Basin:

How should the Basin's water resources be reallocated to reflect the changing values of the community?

Basin governments have worked together in the past to address this through co-operative arrangements including the Murray-Darling Basin Cap and the Living Murray water recovery and works program. Through these processes, water diversions have been capped and moved from consumptive use to the environment, while protecting the reliability and tenure of water entitlements held by individuals and for towns.

The impact of the recent, unprecedented climate conditions on the environment, particularly in the lower Murray in South Australia, prompted the recent change in the way Basin water resources are managed. The increased role of the Commonwealth presents opportunities if changes are effectively developed and implemented. Victoria will work closely and cooperatively with the Commonwealth and other jurisdictions to ensure changes build on existing entitlement frameworks, knowledge and capacity.

The following sections outline the actions Victoria will take to meet the objectives of all Basin communities. The first focuses on the implementation of the Commonwealth's water programs, and the second deals with reforms of the *Murray-Darling Basin Agreement*. The final section clarifies the roles and responsibilities of each government and its institutions. In addition to the Murray-Darling Basin Authority's consultation on the Basin Plan, Victoria will implement these actions through the appropriate interstate processes of the:

- Council of Australian Governments (COAG)
- Murray-Darling Basin Ministerial Council
- Basin Officials Committee.

3.2 Implementation of Commonwealth water programs

In April 2008, the Commonwealth Government announced its Water for the Future³⁹ initiative, a \$12.9 billion investment in water programs over 10 years. Key elements of the initiative are the establishment of the Murray-Darling Basin Authority who will develop the Basin Plan, and a \$3.1 billion commitment to purchase water entitlements for the environment in the Murray-Darling Basin. These programs are discussed in detail in the following sections. The three aspects that will be critical to the successful implementation of these programs are:

- reflecting community values in the decisions made
- ensuring that the volume, reliability and tenure of existing entitlements is protected from changes in government policy
- integrating actions to maximise the community benefits achieved.

Other key elements of the initiative include \$5.8 billion for rural water use and infrastructure and \$1 billion for urban water use.

3.2.1 The Basin Plan

The Basin Plan is expected to be developed by the Murray-Darling Basin Authority and approved by the Commonwealth minister by 2011. The key element will be legally enforceable limits on the amount of water that can be taken from surface and groundwater systems, which will replace the existing Murray-Darling Basin Cap. These are expected to reduce consumptive use and increase allocations to the environment. Depending on the method used to reduce consumptive use, they could reduce the volume or reliability of Victorian water entitlements.

The diversion limits aim to be 'environmentally sustainable'. The *Water Act 2007* defines this as the amount of water that can be taken which if exceeded would compromise the key environmental assets, ecosystem functions, productive base or environmental outcomes of the water resource.

To set these limits, the Basin Plan may:

- identify the environmental assets across the Basin that are to be protected (and therefore which are not to be protected)
- determine the acceptable environmental condition of these assets
- quantify the watering regime to sustain these conditions

- identify how much water needs to be recovered to efficiently provide this watering regime (this requires knowledge about catchment hydrology, the amount of entitlement available to the environmental manager and the need for structural works and complementary measures to enable efficient watering)
- based on the above, quantify any reduction in diversion limits
- quantify the effect of any change in the limits on the volume and reliability of existing entitlements.

Other elements of the Basin Plan include:

- Basin-wide environmental objectives for water-dependent ecosystems
- water quality and salinity targets
- water trading rules.

Methods to comply with the new limits

In setting the new diversion limits, the Commonwealth Government should consider how water use will be reduced to comply with them. There are several methods that move water from consumptive use to the environment; some protect existing entitlements while others do not. The Victorian Government has preferred to rely on water savings, for example by modernising the distribution system (see page 113). The Commonwealth Government has also committed funding of \$1.103 billion to Victorian modernisation projects, and is investing \$3.1 billion across the Basin to purchase water entitlements for the environment (see page 133). Both of these mechanisms move water from consumptive use to the environment without impacting on existing entitlement-holders.

The Basin Plan and the new diversion limits are not able to be implemented without Victorian agreement before 2019. While the Victorian Government expects existing projects to largely address the required reduction in consumptive water use, it is possible the Plan will require further reductions. Without knowing how use will be reduced, the Authority cannot assess the socio-economic impacts of its new limits. The Commonwealth may also need to comply with its requirements to provide compensation payments, which would require detailed modelling to quantify the impact on entitlement-holders in each system.

The Victorian Government supports the Commonwealth's aim of protecting key environmental values in the Murray-Darling Basin. In setting the new diversion limits, there is a need to:

- work to the principle that fair market mechanisms are used to reduce water use, to protect existing entitlements from a reduction in volume or reliability as a result of the Basin Plan
- ensure that the requirements in the *Water Act 2007* for compensation to entitlement-holders are appropriately applied where it is not possible to protect existing entitlements from a reduction in volume or reliability as a result of the Basin Plan
- ensure the processes to reallocate water from consumptive use to the environment are fair and reasonable and reflect community values
- quantify and mitigate the impacts of this reallocation on local communities.

Engaging regional communities

Through the Basin Plan, the Commonwealth Government can now make decisions independently, where previously decisions were made jointly by the states and Commonwealth – through unanimous agreement of the former Ministerial Council. The new arrangements mean the Ministerial Council will now only provide advice and have at least one formal opportunity to return the Basin Plan for reconsideration. This independent decision-making power means the Commonwealth minister and the Murray-Darling Basin Authority will need to develop an appropriate process to consider the views of regional communities.

Decisions about water resource management – including limits on diversions – require trade-offs that balance environmental, economic and social values. Community values must be reflected in these decisions. The Murray-Darling Basin Authority is currently developing an engagement process. This process should be developed with input from key stakeholders, including the Basin Officials Committee. The challenge will be ensuring that a transparent process is developed for making the required trade-offs that includes clear explanation and justification and gives equal consideration to economic, social and environmental impacts.

Community acceptance of the Basin Plan will play a critical role in ensuring the successful implementation of the new limits on diversions. Local groups are unlikely to agree to reductions if doing so would act to nullify their claim for compensation from the Commonwealth. Stakeholder acceptance of the new diversion limits will depend on the credibility of the information used to determine them and the level of engagement undertaken. For communities to accept reduced diversion limits, they must feel that their views have been considered in the development of the limits and that they have been treated fairly. With the release of a draft plan expected in mid-2010 and a final plan in mid-2011, this leaves little time for the Basin Authority to undertake consultation and technical analysis.

Communities are already adjusting to less water use, as a result of the last 12 years of drought and the movement of water as a result of trade. The Commonwealth's programs need to be implemented having regard to the current level of adjustment and ongoing pressures facing regional communities. The Commonwealth expects to purchase 460 GL in Victoria over the next five years (see page 45). If the remaining entitlements were affected by the most severe climate scenario (Scenario D), this would reduce water availability in the Goulburn and Murray systems by 33 per cent and the resulting adjustment issues cannot be ignored. The strategies required to support communities through this adjustment are discussed throughout this document, particularly the linking of water purchases with modernisation projects in Chapter 6. Community-based adjustment strategies are discussed in Chapter 9.

Considering the impacts of climate change

The difficulty of protecting key environmental values under climate change has become apparent through the development of this Strategy. Existing environmental objectives are based on past climatic conditions; but with reduced water availability, it may not be possible to achieve these objectives, even if all the available water is used for environmental benefit (see page 150).

The challenge for the Murray-Darling Basin Authority is to identify key environmental values for protection and set limits that are responsive to climate change. The Murray-Darling Basin Authority will need to provide information to Basin governments and communities about how the effects of climate change will be considered when determining the environmentally sustainable diversion limits.

This challenge will be difficult, particularly in the limited time available until a draft Basin Plan is due. A strategy to adapt to reduced water availability caused by climate change should include identifying:

- climate change responsive environmental objectives
- a clear and transparent process for changing environmental, social and economic objectives
- a process for adjusting the long-term average diversion limits as a result of any change in objectives.

Managing groundwater extractions

Groundwater extractions in the Northern Region are currently limited by PCVs (see page 68), but are not included in the existing Murray-Darling Basin Cap. The Basin Plan will set limits on groundwater extractions.

Victorian experience to date highlights the difficulty in calculating the volume of long-term average sustainable diversion limits for groundwater systems. This is due to a lack of detailed technical understanding, the impacts of climate variability, and limited monitoring and metering data. These difficulties exist for most groundwater systems across the Basin. In response, Victoria has developed management plans which restrict use when groundwater levels fall below agreed target levels, consistent with the management objectives for the system. Other systems may be allowed to decline over time where there are no corresponding groundwater-dependent ecosystems or other impacts. Future management objectives should:

- incorporate the community's economic, social and environmental needs from the resource
- protect identified groundwater-dependent ecosystems, including the contribution to river baseflows
- protect the quality and quantity of the groundwater resource
- provide for the needs of future generations.

This approach is consistent with the management of regulated surface water systems. Groundwater over-use is effectively managed by restricting extractions consistent with existing licence conditions. The approach manages groundwater extractions without defining volumetric long-term average sustainable diversion limits.

Action 3.1: Setting limits on diversions in the Basin Plan

Who: Ministers for Water, Environment and Climate Change;
Department of Sustainability and Environment

Timeframe:
Ongoing to 2011

Encourage the Murray-Darling Basin Authority to undertake the following actions when setting new diversion limits:

- Consider the water recovery mechanisms available for states to comply with the diversion limits and in the Basin Plan, encourage all Basin governments to work to the principle that existing entitlements will be protected from a reduction in allocations or reliability.
- Reflect community values and respond to issues raised through the Basin Plan engagement process. Ideally, regional communities would have the opportunity and sufficient time to consider information about resource conditions, objectives and options to set diversion limits so that the Basin Authority can be properly informed.
- Undertake thorough analysis to assess the community adjustment issues arising from Commonwealth water programs and provide fair and reasonable adjustment support to water-dependent communities.
- Consider the impacts of climate change when setting the diversion limits. Initial steps could include identifying climate change responsive environmental objectives and a clear and transparent process to change environmental, social and economic objectives, and subsequently the diversion limits, if necessary.
- Identify groundwater levels that trigger the introduction of restrictions when required to protect agreed management objectives. These should be used as a proxy for long-term average sustainable diversion limits for groundwater extractions in the Basin Plan.

3.2.2 The Commonwealth's \$3.1 billion water purchase

The Commonwealth has committed \$3.1 billion over 10 years to purchase water entitlement for the environment in the Murray-Darling Basin⁴⁰. The purchase program will move water from consumptive use to the environment.

In June 2009, the Victorian and Commonwealth Governments agreed that where the sale of water is linked to modernisation plans to provide community benefits, they will be exempt from Victoria's four per cent limit on trade out of irrigation districts (see page 108). The Commonwealth expects this will provide 300 GL over and above the water that can be purchased within the limit. Overall, the Commonwealth Government expects to purchase a total of 460 GL from Victoria over the next five years. It is not known if this, together with existing state water recovery programs, will be sufficient to ensure compliance with the new limits on diversions (see page 42). Criteria have been agreed for the first round of exemptions which total 60 GL out of the Commonwealth's 2008/09 water tender.

As part of the negotiations, the Commonwealth reaffirmed its commitment of up to \$1 billion to Stage 2 of Victoria's Northern Victoria Irrigation Renewal Project (NVRP) and \$300 million for on-farm water efficiency works in the southern Basin. It had already committed \$103 million to improve water use efficiency in Sunraysia. Chapter 6 contains more detailed discussion of modernisation and on-farm projects (see pages 113 and 122).

This integrated approach to water purchases and modernisation is a clear example of governments working together to achieve win-win outcomes. It meets the joint aims of achieving a stable and secure future for irrigators, regional communities and the environment. It is important that these opportunities are actively sought and pursued. Another example that is immediately apparent is the integration of water purchases with investment in structural works that reduce the volume of environmental water required.

Integrated investment in environmental water and structural works

The science behind managing rivers and wetlands for environmental outcomes is evolving rapidly, and many lessons have been learnt about managing environmental flows during drought. The amount and

timing of such flows is critical to the protection of environmental assets. Experience has shown that it is most efficient to provide environmental outcomes in regulated systems by:

- increasing environmental flows after undertaking water recovery projects such as water savings or purchase
- transferring water entitlements to environmental managers to maximise management flexibility
- undertaking structural works and complementary measures to ensure water available to the environment is managed efficiently
- refining system operating rules to provide environmental benefit, while minimising impacts on other entitlement-holders.

With the challenge of water scarcity, the recovery of water should not be the only focus in achieving better environmental outcomes. Structural works, such as pumps and regulators, can be used to deliver environmental water and achieve outcomes with much less water (see page 137). For example, planned works at Gunbower Forest include a new channel to deliver environmental water and regulating structures to manage it within wetlands. It is estimated that only 165 GL will be required for a one-month flood, instead of 1,000 GL without the works. Structural works could be a more effective alternative than purchasing water to meet environmental flow objectives, particularly if water availability is reduced as a result of climate change.

Equally important are complementary restoration measures that protect river and wetland health, including water quality, riparian land and in-stream habitat (see page 143). These are particularly important in unregulated river systems where there is little scope to provide additional environmental flows. Unregulated systems account for about 26,000 km or 90 per cent of stream length in the Northern Region.

The Commonwealth's Water for the Future program should aim to deliver integrated environmental outcomes, achieved through an appropriate mix of environmental water, structural works and complementary measures. Consistent with an adaptive management approach, the rollout of the program should be progressive – as water is recovered and used to provide environmental benefit, this should inform decisions about the next best steps. In some cases, this may be additional water purchase, in others, additional structural works or complementary measures.

Action 3.2: Integrated investment in environmental water and works

Who: Ministers for Water, Environment and Climate Change, Department of Sustainability and Environment and catchment management authorities

Timeframe:
Ongoing to 2018

Encourage the Commonwealth Government to focus on achieving environmental outcomes as efficiently and effectively as possible, through an appropriate mix of environmental water, structural works and complementary measures. Victoria will put forward a prospectus of opportunities for structural works and complementary measures by 2010 and encourage the Commonwealth to redirect a portion of its Water for the Future funding to the construction or achievement of these works and measures.

3.3 Reforming the *Murray-Darling Basin Agreement*

As previously described, water sharing between Basin states is governed by the *Murray-Darling Basin Agreement*. The Murray-Darling Basin Ministerial Council oversees the Agreement and is responsible for approving any amendments.

The Agreement has traditionally been effective in managing competition for water resources and settling disputes, but the Basin governments never envisaged the extremely low inflows of 2006/07. In November 2007, the water-sharing arrangements in the Agreement were set aside to ensure that critical human water needs would be met if the 2006/07 inflows to the Murray system were repeated.

Water-sharing arrangements were further discussed at the COAG meeting in July 2008. The resulting *Agreement on Murray-Darling Basin Reform* sets out a three-tier system for water sharing (see Table 3.1), which has now been incorporated into the *Murray-Darling Basin Agreement*.

In mid-2008, the Murray-Darling Basin Commission, predecessor to the Murray-Darling Basin Authority, began work on the River Murray System Operations Review. The aim of the review is to ensure that River Murray operations deliver the objectives of the *Murray-Darling Basin Agreement* in an effective and efficient manner. The review will set out the current arrangements and provide a baseline to assess the consequences of future changes in operating rules on the distribution of shared water in the southern Basin. It will be used to support many of the actions in this section, and will also look at options to address the channel constraint issues associated with the Barmah Choke, including the Murray-Goulburn interconnector.

This effort has been given further impetus through a recent agreement by Basin governments to commence an immediate and comprehensive review of the *Murray-Darling Basin Agreement*. The initial phase of this review, now underway, is being managed by the Basin Officials Committee in accord with a set of agreed principles.

3.3.1 Ensuring river operation during droughts

The experience of recent years has highlighted the risk that the existing reserves* to operate the River Murray are insufficient to deliver critical human needs under extremely dry conditions. Before water can be allocated for consumptive purposes, about 1,650 GL[#] is required from the states' shared resources. Temporary water-sharing arrangements and contingencies have been necessary for river operations since 2006/07.

To avoid circumstances where there is insufficient water to operate the River Murray, and to minimise the uncertainty of ad hoc water sharing arrangements, an additional reserve of water should be established. Chapter 5 outlines actions to establish similar reserves for the region's irrigation distribution systems (see page 88). The key difference is that Victoria, New South Wales and South Australia would each need to contribute water to a River Murray operating reserve.

It is estimated that a reserve of 300-400 GL is needed to ensure river operations in the following year. However, the creation of a reserve requires the transfer of water from existing consumptive entitlements to a shared reserve entitlement. The method used to create and store a reserve may change allocations to, and the reliability of, existing water entitlements in South Australia, New South Wales and Victoria. These impacts need to be assessed, and addressed where appropriate. There will potentially be different costs and benefits to entitlement-holders in each state, so before a reserve is created, a thorough analysis is needed of:

- the options for creating a reserve
- the effectiveness of the options
- the impacts of the options on the amount of water supplied to each state's entitlement-holders, particularly in dry periods
- the measures to be taken to address these impacts.

Table 3.1 Three-tier system for Basin water sharing

Tier No.	Title	Description
1	Normal sharing	The water-sharing arrangements set out in the 2008 <i>Murray-Darling Basin Agreement</i> continue.
2	Ensuring critical human water needs and river operating water are secured	When Tier 1 arrangements provide insufficient river operating water, the Basin Plan will establish a process to determine the necessary water-sharing arrangements to provide it if possible. As outlined in Clause 135 of the <i>Murray-Darling Basin Agreement</i> , any resulting changes to state water sharing must be approved by the Ministerial Council.
3	Extreme or unprecedented circumstances	When inflow conditions are below the worst on record, the Ministerial Council will determine the water-sharing arrangements and contingency measures.

Footnotes:

* Clause 103 of the *Murray-Darling Basin Agreement* states that unless the Ministerial Council agrees otherwise, the minimum reserve is the lesser of: a) a third of the available water, minus South Australia's entitlement, plus any imbalance during a period of special accounting or b) 835 GL.

[#] This includes: 696 GL that must be provided to South Australia each year for dilution flows and the system operating component of the South Australian entitlement; 750 GL to operate the system between the upper Murray headworks storages and the South Australian border; and 200 GL for evaporation from storages.

The objective of a new river operating reserve should be to deliver water for critical human needs assuming there will be historic minimum inflow conditions and that contingency measures identified for 2009/10 continue to be available. Agreement would be helped if the following objectives and principles were adopted:

1. The southern Basin States will share the cost of creating the reserve equally, including changes in water availability to entitlement-holders.
2. Water carried over by entitlement-holders, including individuals and state governments, will be quarantined and not used for river operations.
3. Each state is responsible for ensuring critical human water needs are met within their jurisdiction.
4. Entitlement-holders will be expected to utilise water markets to manage during water shortages and governments will not enter the market to underwrite water allocations to their entitlement-holders during droughts.

It may be possible to use the environmental water from the Commonwealth Government's \$3.1 billion purchase program to support critical human needs in drought years. For example, water being delivered for critical human needs in Mildura and other towns could 'piggyback' on any environmental flows being delivered to the Lower Lakes. This would effectively reduce the amount of water needed to operate the River Murray in drought years. This is consistent with (but the reverse of) the policy outlined on page 140 to use consumptive water en route for environmental and social benefit.

3.3.2 Clarifying storage rights

In addition to the reserve to operate the River Murray, Victoria has its own reserves to support the reliability of its water entitlements and to ensure operation of its irrigation distribution systems. For system reserves and individuals' carryover to be effective, their security must be guaranteed. When entitlement-holders set water aside for use in the following year, they must be confident that this water will be available to them to use or trade as they need. As such, it must be 'quarantined' and not reallocated for system operations or other purpose. Without this guarantee, there is a disincentive to be efficient and use reserves and carryover as risk management tools.

The *Murray-Darling Basin Agreement* enables Victoria and New South Wales to carry over water subject to supplying 696 GL to South Australia each year. The ability to carry over water is now a right of Victorian and New South Wales entitlement-holders and is included in the market value of these entitlements. Previously, under normal circumstances, South Australia was unable to carry over water, but the upper states were obliged to supply 1,850 GL to the South Australian border each year.

The Basin First Ministers agreed in July 2008 that South Australia could carry over water to meet its critical human needs, provided this does not affect upstream states' water availability. Detailed spill rules and water accounting arrangements need to be developed to ensure there are no adverse impacts of South Australian carryover on existing water users. The storage cost of South Australia carrying over water also needs to be determined. Water ordering plans will need to be established to outline the revised pattern of supply to South Australia, together with protocols about how supply can be amended throughout the season if required.



Flooded saplings, Kings Billabong

Photographer: Bob Merlin, Mallee Catchment Management Authority

3.3.3 Improving water accounting

The *Murray-Darling Basin Agreement* outlines procedures to account for water allocated to and used by the states and any spills or releases from storages. Temporary periods of 'special accounting' are declared during water shortages to change the amount of water provided to each state and the Murray-Darling Basin Authority keeps a running record of the credits and debits for each state. Each state is provided with its own 'special account imbalance', but the public cannot easily access this information and they are not independently audited.

There are some water sharing anomalies that should be rectified in the *Murray-Darling Basin Agreement*. For example, the Lindsay River is an anabranch which breaks away from the River Murray about 35 km from South Australia and rejoins just upstream of the border. Victoria provides 91 GL a year out of its entitlement to reduce salinity in the Lindsay River; however the majority of this water continues on to South Australia and can be used by them in addition to their entitlement. In effect, Victoria loses about 70 GL of its entitlement to South Australia. A study has been recently undertaken to identify alternative measures to manage the saline groundwater entering the Murray. The study suggests that some water could

be provided to the Lindsay River en route as part of the normal supply of South Australia's entitlement. This would meet the water quality requirements of diverters and maintain the high environmental assets, such as breeding grounds for Murray cod, in the Lindsay River system, while also addressing the anomaly that results in Victoria losing 70 GL. This saving would be converted to an environmental entitlement. Under Schedule B of the *Murray-Darling Basin Agreement*, Victoria would be accountable for offsetting the salinity impact by allocating a 2.4 EC salinity credit.

The Menindee Lakes storages are on the Lower Darling River in western New South Wales. The operating rules for these storages result in water in the Lakes being used solely by New South Wales under dry conditions and shared by Victoria, South Australia and New South Wales under wetter conditions. If releases from Menindee Lakes reach the Murray during dry periods, another water sharing anomaly results in a reduction in water availability for Victoria and an increase for South Australia, even though this water is accounted for as belonging solely to New South Wales. An increase in the frequency and duration of dry periods as a result of climate change will cause a disproportionate impact on Victoria.

Action 3.3: Reforming the *Murray-Darling Basin Agreement*

Who: Ministers for Water and Environment and Climate Change,
Department of Sustainability and Environment

Timeframe:
Progressively by 2012*

Encourage the Basin governments through the Basin Officials Committee and Ministerial Council to reform the *Murray-Darling Basin Agreement* in the following ways:

- a) Establish a river operating reserve to allow the delivery of critical human needs. This should assume historic minimum inflow conditions and the activation of emergency contingency measures identified for the 2009/10 year. The establishment of the reserve should be guided by agreed objectives and principles (see page 88).
- b) Explicitly state that each state retains control over water that it has carried over, and this water is not included in estimates of shared water resource availability. This includes water carried over by state governments in system reserves and by individual entitlement-holders.
- c) Develop detailed rules for South Australian storage rights and carryover arrangements for private entitlement-holders while protecting the reliability of upstream entitlements.
- d) Require the Murray-Darling Basin Authority to publish water accounts each month showing the water available to each state under the *Murray-Darling Basin Agreement*, and variations from the Agreement. These water accounts should be audited independently each year.
- e) Resolve water sharing anomalies regarding the Lindsay River and Menindee Lakes.

* Dependent on interstate negotiations.

3.4 Powers, institutions, roles and responsibilities

Effective water resource management requires long-term planning arrangements that clearly:

- establish rights to water, their protections and mechanisms to transfer or reallocate rights
- define roles, responsibilities, rights and obligations of water resource managers and entitlement-holders
- prescribe the interactions between governments, water service providers and entitlement-holders.

Under the *Water Act 2007*, the Commonwealth Government now has greater powers over Basin water resource management. Given the number of institutions involved and different water resource management arrangements in each jurisdiction, this change has caused some initial uncertainty about the above points. For the new arrangements to be effective it must be clear who is responsible for what; then each government needs to structure their institutions (that is, their departments and authorities) in a way that best supports their different responsibilities.

3.4.1 Clarifying accountabilities

There are a number of areas where it would be useful to clarify roles and responsibilities. Although the *Water Act 2007* gives the Commonwealth Minister for Water authority to make unilateral decisions, this is based on a referral of powers from the states, and every effort should be made to align policy development with the Basin governments before final decisions are made. Effective water management in the Basin will still rely on a partnership between the states and the Commonwealth.

Table 3.2 outlines several areas of unclear accountability that need clarification as soon as possible with a view to:

- creating incentives to align water management within and between each Basin jurisdiction
- implementing ongoing and effective water reform
- avoiding conflicts of interest between water agencies
- improving the efficiency and effectiveness of day-to-day management
- providing improved and cost-effective services to water entitlement-holders
- providing maximum certainty and flexibility to entitlement-holders to manage their water supply risks.

Table 3.2 Areas of accountability requiring clarification in the new Commonwealth water arrangements

Area to be clarified	Suggested response
The Basin Plan can set Basin-wide objectives and targets for water-dependent ecosystems, salinity and trading. In this co-management arrangement, which government is ultimately accountable for environmental outcomes? Will the Plan set environmentally sustainable extraction limits for all aquifers, including those that are highly localised and make no significant contribution to the shared surface or groundwater resources of the Basin?	<p>The Basin Plan should focus on priorities at a national or Basin scale (for example, Living Murray icon sites and similar; salinity levels in the shared resources; interstate trading rules). The states should retain responsibility for regional and local priorities.</p> <p>The Murray-Darling Basin Authority should map, identify and focus on groundwater systems that contribute significantly to the shared surface water resources of the River Murray for inclusion in the Basin Plan. The states should retain responsibility for the remaining systems, where the direct benefits and costs of management decisions will be local. This includes groundwater resources along the Victorian/South Australian border.</p>
While the Commonwealth Environmental Water Holder (CEWH) is responsible for managing the Commonwealth's environmental water, it is unclear who is responsible for operational functions including water delivery, structural and complementary works. How will these arrangements support the integrated approach to environmental management agreed by COAG?	Clear lines of communication and processes should be established to coordinate decisions by the CEWH, Victorian Environmental Water Holder (VEWH) and catchment management authorities. These should clarify how trade-offs will be made between investment in environmental water versus structural and complementary works. Recognising the competence of state and regional entities to deliver Commonwealth environmental water will likely help this integration.
The Murray-Darling Basin Authority is responsible for developing water resource management policy in the Basin Plan and the delivery of bulk water supplies from the River Murray. These arrangements are inconsistent with the National Water Initiative (NWI - Clause 74) where the Commonwealth and states agreed that, as far as possible, the roles of water resource management, standard setting and regulatory enforcement and service delivery should be separated institutionally.	It would be preferable for the river operation functions to be institutionally and financially independent from the policy and regulatory functions of the Murray-Darling Basin Authority.
The Commonwealth minister has the power to make water-charging rules for the use of irrigation infrastructure, which will be enforced by the Australian Competition and Consumer Commission (ACCC). Will the ACCC duplicate the role of existing state economic regulators, including Victoria's independent Essential Services Commission (ESC)?	State regulators will still be required to regulate pricing for urban water services as the ACCC has no role there. To avoid costly duplication, the ACCC should provide guidelines for rural water-charging rules and where possible accredit state economic regulators to continue to undertake the task.

Action 3.4: Clarifying powers, institutions, roles and responsibilities

Who: Ministers for Water and Environment and Climate Change, Department of Sustainability and Environment

Timeframe: 2010*

Encourage the Commonwealth Government (through COAG and the Ministerial Council) to clarify the split of powers, roles and responsibilities in Basin water resource management, in line with principles agreed by affected governments.

Supporting institutional arrangements should be improved by:

- developing clear processes for integrating the management of environmental water with operational functions
- ensuring the river operation functions of the Murray-Darling Basin Authority are institutionally and financially independent of its policy and regulatory functions
- accrediting the Victorian ESC for economic regulation and other existing state regulatory bodies where possible.

* Dependent on interstate negotiations.

3.4.2 Coordinated management of environmental entitlements

The Commonwealth's water entitlements will be held by the Commonwealth Environmental Water Holder (CEWH), established under the *Water Act 2007*. The CEWH is responsible for managing the entitlements to protect and restore the environmental assets of the Basin and will be guided by the environmental watering plan to be included in the Basin Plan. The CEWH will be responsible for managing a considerable amount of environmental water held in Victorian storages. Concurrently, Victoria's environmental entitlements will be managed by the soon to be established VEW (see page 138). Clear accountabilities, principles and criteria must be established to coordinate the management of rivers, wetland and floodplains at the local, state and Commonwealth level to:

- improve environmental benefits
- ensure integrated, efficient and cost-effective environmental management
- provide for community involvement in environmental objective setting.

Roles and responsibilities in management of rivers, wetlands and floodplains

Chapter 7 outlines the split of responsibilities between regional catchment management authorities, the Department of Sustainability and Environment and the VEW (see page 138). Ideally, the CEWH would use a similar approach to integrate its environmental water within a broader catchment management framework. This may need to be built into the Basin Plan's environmental watering plan. Essentially, catchment management authorities remain responsible for local planning, operations and engagement, including setting environmental objectives and developing watering plans. The VEW, and preferably the CEWH, allocates its water having regard for these watering plans and provides funding for its delivery and management, including associated monitoring.

Suggested principles to guide interactions between the Commonwealth and Victorian Environmental Water Holders

1. Victorian environmental managers have primary accountability for the management of Victorian rivers and wetlands and should be the primary source of management information about these.
2. Commonwealth environmental water that is allocated to Victorian sites will be delivered by catchment management authorities through Victorian delivery processes (that is, Victoria's trading rules, accounting procedures and water register).
3. Where Commonwealth water is allocated from Victorian storages to non-Victorian sites, its delivery will aim to help in achieving environmental objectives for Victorian rivers and wetlands (for example, en route to downstream sites).
4. Each government will fund (through appropriate mechanisms) the delivery, monitoring and management of its own environmental water. Implementation of environmental watering will continue to be undertaken by Victorian catchment management authorities.

Criteria to guide environmental water use

The criteria guiding the allocation of environmental water should be identical at a Commonwealth or state level. To ensure the water is put to its highest environmental use, Victoria and the Living Murray Initiative currently prioritise according to the:

- conservation significance of the site and its plants animal populations
- extent of environmental benefit (for example, the area watered or outcomes achieved)
- significance of the outcomes (for example, a large breeding event by threatened bird species)

- level of certainty of achieving the environmental benefit
- implications of not watering the site
- opportunity to maximise outcomes by integration with other sources of water
- watering history.

Water use must be cost effective and feasible, in terms of efficiency, practicality of delivery and management, and potential risks of watering, such as salinity.

Action 3.5: Coordinated management of rivers, wetlands and floodplains

Who: Ministers for Water and Environment and Climate Change; Department of Sustainability and Environment; Victorian Environmental Water Holder (when established)

Timeframe: 2010

Encourage the Commonwealth Government to participate in coordinated management of rivers, wetlands and floodplains by agreeing on:

- roles and responsibilities in catchment management (similar to Table 7.3)
- principles to guide interactions between the Commonwealth and State Environmental Water Holders (as outlined on previous page)
- criteria to guide environmental water use (as outlined above).



Environmental watering, Crankhandle Lagoon

Photographer: Brendan Rogers, Parks Victoria

4

This chapter outlines actions to protect the security of water entitlements and clarify rights during severe and prolonged dry periods.



Secure rights to water

Guide to the chapter

Section 4.1 Introduction

- Recognising existing rights to water

Section 4.2 Domestic and stock water use

- Why are we concerned about domestic and stock use?
- Options for better management
- Approach to improve management of domestic and stock water use

Section 4.3 Licensed water use from groundwater and unregulated river systems

- Clearly documented licensing rules
- Well-defined limits on entitlements
- Annual processes to allocate water
- Further improvements to licensing arrangements

Section 4.4 Bulk entitlements

- Bulk entitlements for regulated systems
- Bulk entitlements for unregulated systems

Section 4.5 Environmental water reserve (EWR)

- Environmental entitlements
- Environmental obligations on bulk entitlements
- Charges for management of the EWR

Section 4.6 Rights to return flows

What is the issue with the existing arrangements?

Victoria's entitlement framework has effectively allocated water over the past 100 years, but the extremely dry conditions of the past 12 years have highlighted areas for improvement. Under recent water shortages, the Minister for Water has qualified rights to water which redistributes water between entitlement-holders, resulting in uncertainty and inequitable sharing of the available resource.

What improvements does the Strategy make?

- 💧 Improves the management of domestic and stock supplies to protect the environment and reliability of supply for future generations.
- 💧 Clarifies licensing arrangements to better equip groundwater and unregulated water users to manage their own risks under continued low inflows.
- 💧 Refines bulk entitlements to improve certainty for entitlement-holders during periods of water shortages.
- 💧 Quantifies the volume of water required to operate distribution systems to improve the transparency and accountability of system operators.
- 💧 Refines environmental entitlements to maximise benefits and better share the risk of future climate change.

4.1 Introduction

Victoria's entitlement framework, outlined on page 9, aims to clearly define rights to water and promote its efficient and sustainable use for the benefit of present and future Victorians. Traditionally, Victoria's water management arrangements have been effective in providing investment certainty, managing competition for water resources and settling disputes.

The majority of surface water used in the region is by individuals who own water shares. Chapter 5 contains actions to provide greater certainty and flexibility to these entitlement-holders so they can best meet their individual needs. This chapter aims to clarify the remaining rights to water and ensure they are secure even in the face of increased scarcity and competition. The actions in this chapter are designed to:

- improve the management of domestic and stock supplies to protect the environment and reliability of supply for future generations
- improve the management of licensed water use from unregulated river and groundwater systems, particularly to provide clarity to licence-holders about how entitlements will be capped and seasonal variability managed
- clarify bulk entitlements and environmental entitlements to ensure they can cope with extended periods of low inflows and avoid the need for ad hoc decision making and qualifications at times of scarcity.

One water use not currently covered by the entitlement framework is major land use change, such as large plantations. Changes in land use could undermine the reliability of existing entitlements. Work is underway to identify the policy options to account for and manage the impact of land use change on water resources. This work is being progressed outside this Strategy (see page 20) but will include engagement with communities and organisations in the Northern Region.

4.1.1 Recognising existing rights to water

Recognising existing rights to water has been a guiding principle in developing this Strategy (see page 5). The *Water Act 1989* protects existing rights by outlining clear and transparent processes that must be followed to change them.

"... [The submitters] oppose any attempt to remove existing property rights, without adequate compensation. The availability of water is intrinsic to property values..."

– Draft Strategy submission DS134

The Minister for Water can only qualify rights on a temporary basis once all other viable contingencies have been implemented. The qualification must follow clear and transparent guidelines which require a risk analysis including implications for the environment. Equally, the Minister cannot arbitrarily make permanent changes to existing entitlements. Section 51 licences, which are issued for a defined period, can only be amended:

- when a licence is renewed; however the Minister must have regard to a number of matters and must renew the licence unless there are good reasons not to do so (see page 63)
- through the development of a management plan (see page 64)
- following a 15-year review of water resources (see page 11).

Bulk entitlements, environmental entitlements and water shares, which are all permanent rather than renewable rights, can only be amended:

- at the request of the entitlement-holder, for example following the completion of water savings projects (see page 115)
- following a 15-year review of water resources (see page 11).

Reliability and security are two characteristics of a water entitlement. A secure entitlement is one with legal tenure that is certain and protected, with known arrangements for sharing available water during dry and drought years. The reliability of an entitlement relates to the amount of water provided to an entitlement on an annual basis. Reliability may be reduced as a result of climate change, however the right to a *share* of the available resource will be protected.

There have been significant changes in the way water resources are managed within the Murray-Darling Basin and Victoria in recent years. Victoria has been steadfast in protecting the security of the State's entitlements. Ensuring reliable and secure entitlements will give the community continued confidence to invest.

Policy 4.1: Recognising existing rights to water

In advancing the management of water resources in northern Victoria, all existing rights and entitlements, including those of water users and the environment, will be recognised consistent with the *Water Act 1989*. This includes the security of entitlements and the right to a share of available water in a given year.

4.2 Domestic and stock water use

This section summarises the approach to protect current and future water users and the environment from uncontrolled growth in domestic and stock water use.

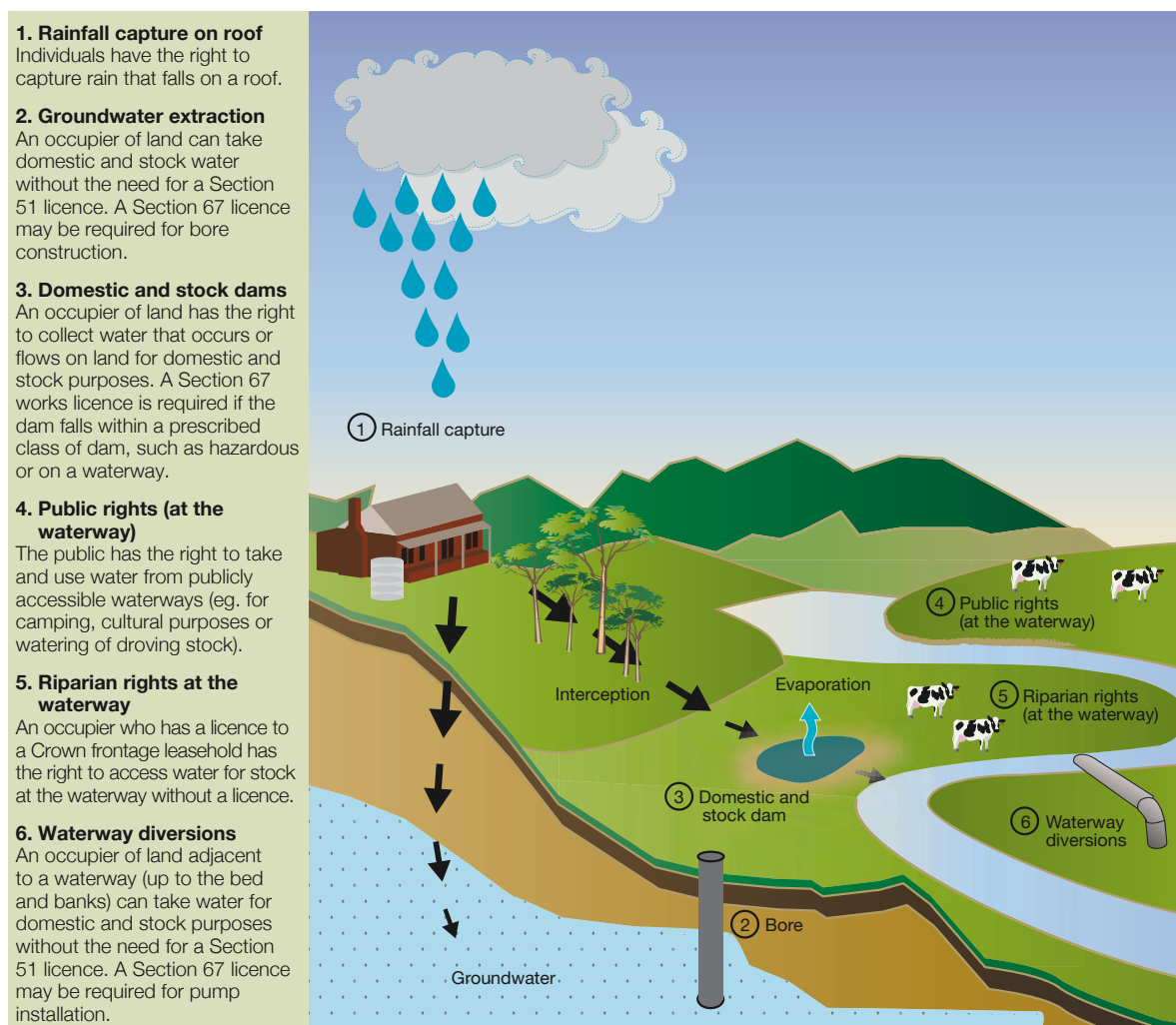
Section 8 of the *Water Act 1989* allows individuals to take and use from surface and groundwater sources for domestic and stock purposes, without an entitlement and free of charge, under specific arrangements (see Figure 4.1). The *Water Act 1989* defines 'domestic and stock use' as the use of water for household purposes, animals kept as pets, the watering of cattle or other stock, watering of land for fire prevention purposes (limited to certain sources) and irrigation of a kitchen garden. A kitchen garden is further defined as a garden used solely in connection with a dwelling; and its size varies depending on when the land was alienated from the Crown and whether the garden is irrigated by surface water, groundwater

or both. The Act excludes the use of domestic and stock water for intensive or commercial uses such as piggeries and dairies and the irrigation of a garden from which any produce is sold. In practice, water captured under the pretext of Section 8 'private rights' is currently also used for purposes not described in the Act (for example, water captured in a dam for aesthetic purposes).

Water use in accordance with Section 8 private rights is essentially an opened-ended right, which means that:

- the location where water is taken is not always recorded
- the volumes taken are not metered
- there are no restrictions in times of shortage
- the security and reliability of water supplies are not protected from the effects of new users entering the system.

Figure 4.1 Rights to water for domestic and stock use (private rights)



4.2.1 Why are we concerned about domestic and stock use?

The impact of domestic and stock use on the environment or existing users comes under little scrutiny because, in most instances, no licence is required. Quality information is scarce on the volume of water used for domestic and stock purposes and the growth in use. This makes it difficult to determine if water resources are being used sustainably. Domestic and stock use could undermine the reliability of supply for all water users because:

- the cumulative impact of historically uncontrolled use could pose a serious threat to water availability at the catchment scale;
- the potential increase in utilisation of these rights may cause additional pressure on water resources and undermine existing entitlements; and,
- the lack of verified data may mean we underestimate the impact of domestic and stock rights on overall water resource availability.

Estimates of existing domestic and stock use have been made using State-wide assessments, bore construction approvals or works licences and specific case studies. These estimates indicate that for northern Victoria, domestic and stock use from groundwater or surface water accounts for about four and six per cent of total water use respectively⁴¹. This proportion will become more significant as overall water availability decreases. Monitoring and better data on growth and existing use is required to ensure impacts can be appropriately managed as they arise.

At a local scale, some catchments are more impacted than others by domestic and stock use. Detailed investigations in the Campaspe catchment (see Background Report 1) show that small catchment dams intercept 11 per cent of surface water assuming long-term average conditions, and 29 per cent under a continuation of recent dry conditions. Unlicensed domestic and stock dams make up between 80 and 90 per cent of this total.

Rapid growth in the number of domestic and stock dams has occurred as a result of the increased numbers of 'lifestyle' farms around large urban areas. Figure 4.2 shows an example of the growth in domestic and stock dams within the Mt Ida region of the Campaspe catchment, from 1982 to 2008. The Campaspe system has several areas where such development can occur, because farming properties have been subdivided into smaller land parcels.

This proliferation of domestic and stock dams is occurring in rural residential areas across the state. A large number of subdivided allotments are available to be built on, which could further increase the number of domestic and stock dams and bores. These allotments are generally found in the Rural Living Zone, but significant numbers are also located in the Farming Zone. As an example, around Melbourne's fringe there are currently 53,000 parcels (or lots) of land that do not have houses, but could activate their domestic and stock rights⁴².

The use of groundwater for domestic and stock purposes is also increasing. Approximately 60,000 groundwater bores have been constructed in Victoria since the 1970s with more than 16,000 constructed since 2006⁴³. Growth is likely to continue in rural areas as land is developed and in reticulated urban areas where land-holders seek to avoid water restrictions.

Figure 4.2 Domestic and stock dams in the Mt Ida sub-catchments, Campaspe Basin (aerial photograph)

a) As a rural setting in 1982



b) As a peri-urban subdivision in 2008



Source: Coordinated Imagery Program,
Department of Sustainability and Environment

Public support for improved management

The Draft Strategy asked several questions about managing domestic and stock water use and specifically about small catchment dams and groundwater use. Many submissions acknowledged the limitations of current arrangements, especially in controlling the proliferation of domestic and stock dams in rural residential areas.

“There needs to be a dramatic overhaul of the farm dams policy in Victoria and across the Murray-Darling Basin. The proliferation of on-farm dams in the last 15 years is compounding the effect of drought.”

– Draft Strategy submission DS163

There was no consensus on changes that may be required to manage domestic and stock use into the future. Responses ranged from no action to targeted management to calls for a comprehensive licensing regime. Support for a comprehensive licensing regime for domestic and stock use of groundwater was stronger than for dams. Submissions cited cap compliance, protection of the resource and lack of understanding of the groundwater resource as reasons why it should be licensed for domestic and stock use. Other submissions raised concerns about the cost of increased regulation of domestic and stock water use outweighing the benefits.

National obligations

The National Water Initiative requires that by no later than 2011, ‘significant’ interception activities must be recorded, and use above a certain threshold must purchase water entitlements. It is unclear whether domestic and stock use will be classified as significant, although it clearly can be significant at a local scale, such as the Mt Ida catchment.

The Murray-Darling Basin Cap does not formally account for domestic and stock use, which is not currently limited in any way. The Cap will be replaced by environmentally sustainable limits on diversions set in the Murray-Darling Basin Plan (see page 42). The Basin Plan could adopt a similar approach to the current Cap, or it could seek to account for and limit domestic and stock water use. Victorian water users would be exposed by not having a management framework that adequately records and accounts for domestic and stock water use.

4.2.2 Options for better management

Four broad options emerged from public responses to the Draft Strategy to govern the overall management of domestic and stock water use. These range from recording use through to a comprehensive licensing regime covering all water use (see Figure 4.3 and Table 4.1).

Figure 4.3 Domestic and stock management options

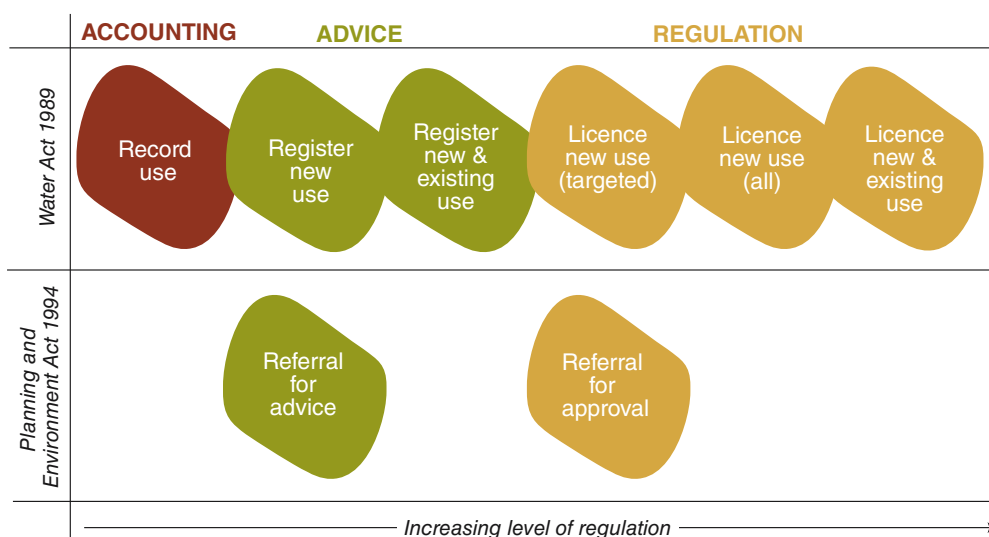


Table 4.1 Broad options for managing domestic and stock water use

Option	Comment
Recording use	<p>Records and tracks use over time using: a) regulations to report use; b) photographic imagery; or c) self-assessment procedures.</p> <p>Improves datasets and tracks changes in use but would be expensive on a State-wide basis. In addition, this option only provides retrospective analysis, which cannot be used to promote sustainable use of the resource.</p>
Requiring referrals under Victorian planning provisions	<p>Requires property owners to obtain a planning permit before constructing a new domestic and stock dam. The application for a permit would be referred to the relevant water corporation for advice or approval.</p> <p>Some councils already require a permit to construct a dam. However, the approach is not consistently applied across the State; only some councils refer permit applications to water corporations and even where permits are required, this has not provided useful data. Very clear directions would need to be given to ensure the approach is applied consistently across all municipalities.</p> <p>This option would not entirely solve the problem without also providing water corporations with clear directions on how they should consider and process any referral.</p> <p>This option is not consistent with the approach adopted for commercial farm dams, which sought to reduce the regulatory burden and avoid duplication by regulating commercial farms dams through one agency (i.e. the relevant water corporation). Duplication at the permit approval stage should be avoided, but a complementary approach between planning provisions and the <i>Water Act 1989</i> may be appropriate at earlier stages in the planning cycle (e.g. new developments and subdivisions).</p>
Registering use	<p>Registers new domestic and stock use from all/some sources (including dams).</p> <p>Improves datasets and provides an opportunity to promote sustainable use of water resources in accordance with guidelines for reasonable domestic and stock use (see page 61) because registration would be required before constructing a dam or bore.</p> <p>While it would be possible to register existing use, this would be expensive and would not provide an opportunity to promote sustainable use of the resource.</p>
Licensing use	<p>Converts Section 8 right to a right subject to obtaining a Section 51 licence.</p> <p>Represents the most substantial change from existing rights and would be extremely costly and resource intensive. These costs could not be justified on a State-wide basis.</p> <p>However, this option is best for resource protection as it provides the greatest capacity to redistribute water to the highest value use and prevents growth in use if this is not sustainable.</p>

Background Report 13 considers each of these options in more detail. Each option is evaluated in terms of the ability to:

- recognise and protect existing water users;
- be easily understood and straight forward to administer;
- account for and encourage the efficient and sustainable use of available resources; and,
- ensure that the benefits of a new system outweigh the costs.

4.2.3 Approach to improve management of domestic and stock water use

The challenge is to manage the risk of domestic and stock use where required, without imposing significant costs or preventing regional growth in areas where the resource is not stressed.

The preferred approach is to improve our understanding and management of domestic and stock use by registering new use in high risk areas and monitoring growth in domestic and stock use over time. As well as registering new use in high risk areas, the Minister for Water will issue guidelines on 'reasonable domestic and stock water use' to promote sustainable use. The Minister for Water will also commission a review of domestic and stock management once more is known about how domestic and stock use will be treated in the Murray Darling Basin Plan, due for release in 2011.

Registering new use in high risk areas and monitoring growth

We already register all new domestic and stock groundwater extractions, most waterway diversions and some forms of private dams through the process of requiring a Section 67 'works licence' for bore construction and works on waterways. These licences ensure minimum construction standards and also provide information about the nature and location of the works and provide an opportunity for information to be shared between prospective users and the water corporation before a bore or pump is constructed.

Based on public feedback on the Draft Strategy and evidence from the Campaspe Basin case studies (refer to Background Report 1), the Government will require all new stock and domestic dams in rural residential 'lifestyle' areas to be registered with the relevant rural

water corporation before they are constructed or altered. Most stakeholders agreed that these areas pose the greatest risk for expansion of domestic and stock dams within the landscape.

Registration of new stock and domestic dams in rural residential areas will:

- provide an accurate record of the location and nature of new domestic and stock use on rural residential properties;
- seek to ensure dams do not exceed the capacity required to meet the definition of 'reasonable domestic and stock' needs and meet all construction standards; and
- improve information sharing between prospective users and the water corporation before a dam or bore is constructed, including advice on alternative supplies.

Private dams (that is, domestic and stock dams) may also require a Section 67 work licence before they are constructed or altered if they fall within a prescribed class of dam that will have certain height and capacity characteristics. Landholders will be advised if their proposed construction or alteration of a dam requires a Section 67 licence when they register their proposal with the relevant water corporation.

Registration of new use in rural residential areas will be coupled with existing tools to track domestic and stock use over time. Tracking growth in domestic and stock use will provide the ability for each water corporation to assess the impact of use on available water supplies. This information will inform future decisions on whether more active management is required to protect existing water users and the environment.

Action 4.1: Improving management of domestic and stock water use

Who: Department of Sustainability & Environment, rural water corporations, local councils, catchment management authorities

Timeframe: 2009

Management of domestic and stock water use will be improved by:

- requiring the registration of all new or altered domestic and stock dams within rural residential areas and promoting sustainable use in accordance with guidelines for reasonable domestic and stock use (see Action 4.2);
- monitoring growth in domestic and stock use; and,
- clarifying the need to obtain a Section 51 licence for harvesting water for uses other than domestic and stock purposes.

Defining 'reasonable' domestic and stock use

It is difficult to define a reasonable volume of water for domestic and stock water use at a specific site from the definition in the *Water Act 1989*. To assist licensing authorities and landholders to determine reasonable domestic and stock use consistent with the Act, ministerial guidelines will be developed.

The guidelines will provide clarity as to the purposes for which domestic and stock use applies and also provide for the consistent calculation of 'reasonable domestic and stock' volumes for any new assessment of domestic and stock needs, thereby promoting sustainable use of the resource. The calculation of reasonable use will be based on the area of a property, local climatic conditions, stocking rate in the local area, the reliability of water supplies, the water needs of a typical household and the needs for fire protection.

These requirements will apply to water taken from groundwater bores, extracted from a waterway or captured within a dam.

The guidelines will be an important tool for property owners when planning for their water needs and for local councils that require works applications to build stock and domestic dams. The guidelines will also assist referral agencies such as water corporations and catchment management authorities when considering the water supply needs of new developments.

Adapting to requirements in the Murray-Darling Basin Plan

As mentioned above, it is not as yet clear how the Murray-Darling Basin Plan will address domestic and stock water use. On release of the draft Basin Plan, Victoria's approach (described in Action 4.1 and 4.2) will need to be examined against what has been

prescribed within the draft plan and any required changes to the way we manage domestic and stock use will need to be made before the final Murray-Darling Basin Plan is released in 2011.

Promoting efficient use of water

Requiring rural residential land-holders to contact their local rural water corporations before constructing a new domestic and stock dam will promote efficient capture and use of water. For example, having small, shallow dams in every paddock is very inefficient and over summer these dams tend to dry up and fail. Alternatively, a larger deeper dam piped to each paddock has lower evaporation rates and is a more reliant supply. Evaporation rates are highest in areas of low rainfall and low humidity; as high as 1.8 metres a year. Evaporation rates are also expected to increase by between two and 10 per cent as a result of climate change (see Figure 2.5).

Rural water corporations will be able to advise landholders of the best options for securing their domestic and stock requirements; this may include access to reticulated domestic and stock supplies (see Action 8.2). Promoting efficient domestic and stock water use is important for individual land-holders to ensure they have sufficient supplies to meet their needs, as well as ensuring maximum water is provided to downstream users and the environment.

Local government also has an important role to play in planning future developments and considering the potential impact of regional growth on existing water supplies. Every opportunity to promote use of the most sustainable supplies should be encouraged and in some areas, where there is evidence of resource stress, options to prevent the proliferation of domestic and stock use through planning controls should be explored.

Action 4.2: Determining 'reasonable domestic and stock guidelines'

Who: Department of Sustainability & Environment, rural water corporations, catchment management authorities, stakeholders, local government

Timeframe: 2010

The Minister for Water will issue technical guidelines on calculating the maximum volume of 'reasonable domestic and stock use' to ensure consistency and fairness in exercising Section 8 domestic and stock rights. A steering committee will be established to advise on the development of these guidelines.

The guidelines will be used to promote sustainable domestic and stock water use and will assist water corporations and landholders to determine if a Section 51 licence under the *Water Act 1989* is required.

Action 4.3: Reviewing the approach to domestic and stock water management

Who: Department of Sustainability & Environment, rural water corporations, catchment management authorities, stakeholders

Timeframe: 2011

A steering committee with members from key stakeholder groups, including farmers, will be appointed to assess the implications of the draft Murray-Darling Basin Plan on Victoria's approach to the management of domestic and stock water use. The committee will report to the Minister for Water on its findings.

This review will also consider the growth of domestic and stock use in resource stressed areas and the effectiveness of the reasonable domestic and stock guidelines in promoting efficient use of water.

4.3 Licensed water use from groundwater and unregulated river systems

In groundwater systems and unregulated river systems (that is, with no large dams or weirs), the Victorian Government allocates water by issuing individuals with a Section 51 licence to take and use water from:

- waterways
- on-stream and off-stream dams
- springs and soaks
- works of an authority
- groundwater.

A licence provides for the maximum volume of water that can be extracted from a defined source of water, and includes a range of conditions. Licences may be issued for up to 15 years and the *Water Act 1989* permits new or changed licence conditions to be included.

To access water under a Section 51 licence, the holder will also need to operate works. This may involve the construction of a bore or dam and/or the use of pumping equipment which require a Section 67 works licence.

The management of unregulated river and groundwater systems has developed over recent decades in response to changing conditions.

“The management of unregulated systems has changed over time and the access to water for licence-holders has often been reduced through increased rationing or bans.”

– Draft Strategy submission DS068



Dam excavations

Photographer: Alison Pouliot

The need to change groundwater management in particular has become evident in recent years due to increasing use and value of the resource. Over the past 12 years, people have turned to groundwater to provide emergency supplies in response to drought. Towns historically supplied from surface water, such as Wangaratta, have put in bores to secure supplies. Many farmers have also put in bores for domestic and stock supplies when their farm dams have dried up. This trend is likely to continue, with deeper, previously non-viable groundwater sources being accessed and poorer quality resources being used after treatment.

A decade ago the emphasis was on managing rising groundwater levels and the resulting land salinity problems. Management has now started to adapt to increased use, climate change and falling groundwater levels. Examples of improved management have included: capping local resources; metering commercial and irrigation use; preparing management plans; restricting use when required; allowing trade; and increasing licence fees. In addition, Victoria has established a comprehensive state observation bore network to monitor groundwater levels and recharge rates. 1,056 state observation bores are located at 606 monitoring sites across northern Victoria.

Groundwater management is complex. While licensing arrangements are similar to unregulated rivers, some groundwater resources have significant storage capacity; this means some groundwater systems are similar to regulated river systems.

Whenever possible, all licencing arrangements should aim to mirror the key characteristics of regulated entitlements, which have allowed customers to invest with certainty and manage their own risks in the face of continued low inflows. These characteristics include:

- clear documentation of processes and rules used to manage entitlements and seasonal variability (see page 63)
- well-defined limits on the volume of entitlement that can be issued and certainty around the timing and processes for revising the limits (see page 67)
- well-defined and transparent annual processes to allocate water to entitlements (see page 69)
- the ability to trade and move water to its highest value use (see Chapter 5)

4.3.1 Clearly documented licensing rules

The responsibility for issuing licences to take and use water in northern Victoria has been delegated to Goulburn-Murray Water. Ministerial guidelines are issued outlining how this delegated function is to be performed including performance standards, roles and responsibilities and the application of new management tools. The guidelines will be amended to clarify the expectations on licensing authorities and to improve consistency in this role across the Northern Region and the state. The first stage of this process was completed in September (2009) with the release of revised 'Policies for Managing Take and Use Licences'.

Across the state this licensing role sits with a number of different water corporations, resulting in varying conditions being placed on licences. To provide consistency across Victoria, a standard set of licence conditions will take effect from September 2009. All new licences issued will include the set of standard licence conditions as well as site-specific conditions and all existing licences will be updated with the standard licence conditions when they are renewed or traded.

There is an ongoing commitment to improve the recording and transparency of licence information to enable proper accounting. All licences will be recorded on the Victorian Water Register from the second half of 2009. This will benefit licence-holders and licensing authorities by improving water accounting and facilitating trade and carryover of licence volumes.

Across northern Victoria there are about 120 unregulated rivers, 15 GMAs and WSPAs with active diversions or extraction, and currently unincorporated groundwater areas. The characteristics of these systems, including water availability, can differ significantly. Therefore, in addition to ministerial guidelines that describe state-wide arrangements, it is appropriate to have flexibility in local management arrangements. Depending on the required level of management in a given system, two approaches have been employed:

1. Local management rules apply where water resources can be managed without the need to change licence conditions and the rules govern how licensing arrangements and functions apply to a local system.
2. Management plans apply where changes to licence conditions are required to protect domestic and stock users, existing licence-holders and the environment.

Action 4.4 Ministerial guidelines for licensing of unregulated and groundwater supplies

Who: Department Sustainability and Environment; rural water corporations

Timeframe:
Ongoing until 2011

Ministerial guidelines for delegated licensing functions will be reviewed to:

- enable clear, transparent and equitable management of Section 51 licences
- confirm arrangements regarding the issuing of licences, setting/revising permissible consumptive volumes and the role of sustainable diversion limits for surface water systems
- outline a consistent, straight-forward process for the development of local management rules and associated roles and responsibilities
- clarify opportunities for licence-holders to access tools such as trading and carryover of licence volumes
- outline the roles and responsibilities of the relevant parties (including water corporations and catchment management authorities) in the management of groundwater and unregulated rivers and associated diversions.

Action 4.5: Standard licence conditions and improved records of licence information

Who: Department of Sustainability and Environment; rural water corporations

Timeframe:
Ongoing from 2009

A set of standard licence conditions will be developed for Section 51 and Section 67 licences. All new licences will be issued based on the standard licence conditions. Existing licences will be updated to reflect the standard licence conditions at the time of their renewal, trade or transfer.

The Victorian Water Register will record all bundled water entitlements (including Section 51 and Section 67 licences, environmental entitlements and bulk entitlements).

Local management rules

Section 51 licences include conditions for the take and use of water. Local management rules explain to licensees (and the broader community) the specific management arrangements for the water resource from which they extract and the rules that apply to them as users of that resource. They explain how water will be shared in times of shortage.

Local operating rules have already been developed by rural water corporations over many years in consultation with affected licence-holders or in response to water shortages. However, they have little formal recognition. These rules are now critical for defining rights to water and to protect the environment, and the process for setting and amending the rules needs to be formalised. The development of local management rules will be guided by Ministerial guidelines (see page 63).

Management plans

Arrangements documented in local management rules will provide a sufficient level of management for most unregulated rivers and groundwater systems. However, in highly stressed systems, the water-sharing arrangements or the total licensed volume committed from the resource may need to be revised. In these cases, a WSPA will be declared in accordance with Section 32 of the *Water Act 1989* and a management plan prepared which may change licence conditions prior to the renewal of the licence.

The development of a management plan for a WSPA can take 18 months or longer and requires the Minister for Water to appoint an overseeing consultative committee and extensive consultation with licensees. This process will be reviewed to ensure it operates as efficiently as possible.

Action 4.6: Developing local management rules for groundwater and unregulated river systems

Who: Department of Sustainability and Environment; Goulburn-Murray Water; catchment management authorities

Timeframe: Progressively to 2015

Local management rules will be formally documented, adopted and published for all surface water and groundwater systems that do not require a management plan. They will document (if applicable):

- the area to which they apply
- management objectives
- any limits, including sustainable diversion limits, permissible consumptive volumes or extraction limits that apply to the area/system
- surface water passing flow requirements for summer and winter
- trigger levels for applying restrictions on groundwater licences
- rules for applying rosters and bans for surface water and groundwater systems
- groundwater carryover (where appropriate)
- trading zones and rules
- monitoring and reporting requirements
- additional requirements specific to the system.

Existing operating arrangements for northern Victorian surface water systems will be formalised as local management rules. Where no formal arrangements exist, or where existing operational arrangements are insufficient, local management rules will be developed in consultation with catchment management authorities, the Department of Sustainability and Environment, local communities and urban water corporations. In developing local management rules, the rights of existing licence-holders and the environment will be recognised.

Action 4.7: Developing and streamlining management plans

Who: Department of Sustainability and Environment; Goulburn-Murray Water

Timeframe: Ongoing

WSPAs will be declared and a management plan developed for highly-stressed or utilised systems if:

- there is a need to amend licence volumes or conditions before licence renewal
- permanent or ongoing restrictions on licensed extraction are required to protect consumptive licences, domestic and stock use or the environment
- overall licensed commitment needs to be reduced

The process for developing management plans will be reviewed to identify options for streamlining.

Through *Our Water Our Future*, five unregulated rivers and six GMAs were identified as priority systems for the development of a management plan. Since then, technical studies and resource appraisals have been completed, resulting in a reassessment of priorities in northern Victoria. Several external factors will influence the level of management required. For example, the February 2009 bushfires impacted the hydrology of

the Yea River and King Parrot Creek catchments, as well as on local communities and licence-holders. Due to the uncertainty surrounding the bushfire-affected areas, intensive management for these catchments is currently inappropriate.

For these reasons, the management arrangements for these priority systems have been revised (see Table 4.2).

Action 4.8: Revised management arrangements for *Our Water Our Future* priority systems

Who: Goulburn Murray Water; catchment management authorities; Department of Sustainability and Environment

Timeframe: Various (see table below)

Management arrangements for each of the priority areas identified within *Our Water Our Future* will be revised as per Table 4.2.

Table 4.2 Summary of actions for priority groundwater and unregulated river systems identified in *Our Water Our Future* (2004)

Action	System
Maintain existing water supply protection areas and associated management plans	Campaspe Deep Lead WSPA (2010), Katunga WSPA (complete) and Shepparton WSPA (complete). Spring Hill WSPA and Upper Loddon WSPA will be merged and a single management plan will be developed by Goulburn-Murray Water in consultation with the North Central Catchment Management Authority, the Department of Sustainability and Environment and relevant urban water corporations by 2010.
Declare water supply protection areas and associated management plan	A integrated groundwater and surface water management plan will be developed for the upper Ovens system by Goulburn-Murray Water in partnership with North East Catchment Management Authority and the Department of Sustainability and Environment by December 2010.
Develop local management rules	Mid-Loddon GMA and King Parrot Creek and Yea River WSPAs will be revoked and local management rules developed by 2011 for each system in place of a management plan. Local management rules will be developed for the Kiewa River and Seven Creeks by 2011.

One of the objectives of the NWI is to recognise the connectivity between surface and groundwater resources; it recommends management of connected systems as a single resource. Management should recognise that in some connected systems increased groundwater extraction can reduce streamflow and therefore the reliability of surface water entitlements. Allocation, trade and management rules must recognise the level of interaction.

With the exception of the upper Ovens system, groundwater systems in the Northern Region do not strongly interact with surface water systems⁴⁴. However, where there are significant connections, the *Water Act 1989* provides for joint management plans to be prepared.

An integrated management plan is being developed for the upper Ovens, which has been identified as a highly-connected groundwater and surface water system. The outcomes of this process will be used to inform the management of highly-connected systems in the future.

It is important to note that integrated management does not mean issuing a single licence that provides access to both surface water and groundwater from a defined system. It means that water extracted from one source of water (for example, groundwater) considers the impact on the other source of water (for example, contribution to river baseflows).



Groundwater drill

Photographer: Alison Pouliot

Action 4.9: Managing groundwater / surface water interaction

Who: Goulburn-Murray Water; catchment management authorities; Department of Sustainability and Environment **Timeframe:** Ongoing

Systems with high groundwater and surface water interaction will be identified and integrated management plans prepared.

The outcomes of the upper Ovens integrated management plan will be used to progress the development of other integrated plans.

4.3.2 Well-defined limits on entitlements

Critical to the success of Victoria's entitlement framework are clearly defined limits on the volume of entitlements issued.

The volume of entitlement that can be issued is currently limited by the Murray-Darling Basin Cap, and Victoria's PCVs. By 2011, the Murray Darling Basin Authority will set environmentally sustainable limits on the amount of surface and groundwater that can be taken (see Chapter 3). These limits will replace the Murray-Darling Basin Cap but they will not be introduced in Victoria before 2019.

The Murray-Darling Basin Cap applies to licensed water extraction including from unregulated river systems. As such, no new licences can be issued

in the Northern Region. However the Murray-Darling Basin Cap does not account for any unlicensed water diversions which can be divided into two categories:

- water used for domestic and stock purposes (see page 60)
- unlicensed farm dams primarily for dairy wash (see page 70).

In the event that these uses become licensed, improved management and accounting of these existing uses must not have any unintended third party impacts. Therefore Victoria will work with the Murray-Darling Basin Authority to ensure that limits are increased to formally recognise these existing uses of water.

Action 4.10: Limiting entitlement volumes in unregulated river systems

Who: Department of Sustainability and Environment

Timeframe: 2012

The accounting of authorised, currently unlicensed water use in unregulated river systems will be improved through its recognition under the Murray-Darling Basin Cap on diversions. For example, water extracted for dairy wash (when formally accounted through registration or licensing), and water extracted for stock when crown frontages are fenced off and licences are issued to recognise historical use (see Action 7.5).

Currently GMAs and WSPAs are based largely on topographic features in areas of intensive use. They do not cover all potential groundwater sources (see page 12) and boundaries may not fully reflect physical boundaries and aquifer characteristics. In response to increasing groundwater demand and improved understanding of systems, the Department of Sustainability and Environment is reviewing the boundaries of GMAs and WSPAs.

In the Northern Region, the volume of groundwater entitlement that can be issued in a GMA or WSPA is limited by PCVs. These have been set at either the volume of existing entitlement or based on an assessment of groundwater system yield, whichever is greater. Authorised but unlicensed uses of the resource are not limited by PCVs; this includes water for domestic and stock or in some instances dairy wash purposes and in some situations interception by plantations. PCVs have not been set for unincorporated areas.

PCVs may not necessarily represent sustainable levels of use for a groundwater system. Sustainable management should be based on agreed management objectives for a given system. In some instances, it will be reasonable to allow groundwater levels to decline to prevent land salinity problems. In other cases, community benefits will be maximised by maintaining stable groundwater levels. Finally, in some instances it may be possible to increase the amount of water taken from some groundwater systems. This will be permitted where it can be safely done and it provides value to the community.

Any rebalance between consumptive use and the environment must maintain the integrity of water entitlements.

Action 4.11: Defining areas and limiting entitlement volumes in groundwater systems

Who: Goulburn-Murray Water; Department of Sustainability and Environment

Timeframe: 2012

Groundwater management area and water supply protection area boundaries will be reviewed based on the latest hydrogeological information, and groundwater management areas will replace unincorporated areas.

Once defined in management areas, permissible consumptive volumes (PCVs) will be progressively set and gazetted. These will consider current licensed extractions, estimates of unlicensed use (that is, domestic and stock), future extraction capacity of the resource and the needs of groundwater-dependent ecosystems.

Existing groundwater PCVs will be adjusted upwards:

- to account for water extracted for dairy wash
- to account for existing authorised but unlicensed water use, such as domestic and stock
- where it is determined that groundwater systems can sustain extraction above that currently allowed
- under existing PCVs, only after a resource appraisal that considers the needs of existing users and groundwater-dependent ecosystems.

4.3.3 Annual processes to allocate water

Once limits are set on the entitlement volume, the next step is to restrict annual water use in response to seasonal variability.

In regulated systems, the amount of water available to an individual in any year is termed a 'seasonal allocation'; this allocation process is well understood by entitlement-holders. There is a clear relationship between allocations, entitlement volume and storage levels and entitlement-holders understand that there is no guarantee that they will receive 100 per cent allocation in any given year. The rules are designed to allocate water only when it is available.

For unregulated rivers there is no large on-stream storage capacity; instead it is necessary to manage instantaneous flows. In these systems, seasonal variability is managed by introducing restrictions and bans on licensed extraction when a system hits a point of stress. These are known as minimum passing flows. The objective of restriction rules is to share the available flow between all licence-holders while maintaining a minimum flow in the stream. This means that a licence-holder may be able to take their full entitlement over the period specified by the licence conditions, but they may be banned from taking water for some months of the year when river levels are too low. Restriction rules have been established on a needs basis for streams in northern Victoria, however, the process for reviewing, revising and publishing them needs to be formalised to better protect the environment and the rights of licence-holders. This will be done through the development of local management rules and management plans (see page 64).

Access to groundwater resources can be restricted in the same way as unregulated streams, but this has not been a common practice in northern Victoria as groundwater has been a generally secure resource over the last 12 years. Where rates of decline are identified, restrictions are introduced to protect agreed management objectives that reflect community's economic, social and environmental needs. The frequency and period of restrictions depend on the characteristics of the local system, and accordingly will be governed by local management rules and plans. It is important to formalise these arrangements and make them easily accessible to all licence-holders and the broader community.

Where groundwater aquifers provide significant storage capacity, they behave more like regulated systems, and therefore it may be possible to use seasonal allocations, rather than restrictions to share the available resource. While they are conceptually similar, seasonal allocations allow water to be allocated at the start of a season based on the resource status, rather than restricting extraction once a system is under decline.

Action 4.12: Managing seasonal variability in unregulated river and groundwater systems

Who: Goulburn-Murray Water; Department of Sustainability and Environment

Timeframe:
Progressively to 2015

Appropriate restriction policies for groundwater and unregulated river systems will be developed through local management rules and management plans, including levels or minimum passing flows that trigger the introduction of restrictions.

The merits of using seasonal allocations, rather than restrictions, will be investigated for appropriate groundwater systems by 2011.

4.3.4 Further improvements to licensing arrangements

Unbundling Section 51 licences

It may be appropriate to 'unbundle' some or all licences in the same way that water rights were unbundled into a water share, delivery share and water-use licence for regulated systems in 2007. Unbundling provides an opportunity to clarify entitlements and provide consistency across Victoria. However it is not clear how a water share could be defined for a diversion from the unregulated system.

A water-use licence, linked to the water share, requires water to be applied to land in a sustainable way. Water from a Section 51 licence is not subject to the water-use licence. In areas where land-holders have a water share and a groundwater licence, the licensed volume can be applied on this land in excess of the volume specified on the water-use licence. This problem could be overcome if the licence was unbundled, in which case the water-use licences would regulate all water applied to the land.

Some of the benefits of unbundling can be achieved by clarifying licence conditions (for example, the conditions by which water can be applied to the land). More work is required to determine the benefits of unbundling Section 51 licences.

Management of sleeper licences

Many Section 51 licences are currently inactive, used sporadically or only partially used. For example, sleeper licences represent between 14 per cent (Kiewa) and 53 per cent (King Parrot Creek)⁴⁵ of the total licensed volumes in unregulated systems. In 2006/07, groundwater usage in the Upper Loddon, Shepparton and Spring Hill WSPAs was less than 50 per cent of entitlement volumes. This level of under-utilisation is not as evident in regulated catchments where entitlements and allocations are actively sold on the water market.

There is some concern that the increased utilisation of existing licences could reduce the reliability of supply for other users and on the environment. However, an individual who does not fully utilise their licence has the same legal rights as one who does fully utilise their licence, and pays the same fees and charges.

Management of dairy wash licences

Historically, water used to wash down farm dairies was estimated to be relatively small. In most instances, Section 51 licence volumes were below the actual volumes used or no licence existed as it was incorrectly assumed to meet the definition of Section 8 rights. This position represents a historical inconsistency between policy and accounting for actual dairy wash use.

Action 4.13: Unbundling Section 51 licences

Who: Department of Sustainability and Environment

Timeframe: 2010

Options to unbundle Section 51 licences will be investigated for:

- surface water systems that are part-regulated (Kiewa River) or semi-regulated
- deep lead groundwater systems with large storage capacity
- areas where land-holders hold both water shares and licences.

Policy 4.2: Sleeper licences

The rights of Section 51 licence-holders will continue to be recognised, independent of their historic water use and if activated, will be subject to the same management rules applied to active licence-holders (for example, restrictions or bans at times of scarcity).

Action 4.14: Management of dairy wash licences

Who: Department of Sustainability and Environment; Goulburn-Murray Water

Timeframe: 2010

A dairy wash licence transition program will be implemented until the 26 February, 2010. During this period, land-holders without a Section 51 licence, or with a Section 51 licence that does not sufficiently represent their current water use for dairy wash, can apply to have a new/revised licence issued based on historical or agreed usage. All these licences may be metered, subject to additional conditions issued by the water corporation, and will incur ongoing fees and charges.

4.4 Bulk entitlements

The following section describes how bulk entitlements will be amended to include water-sharing arrangements that have been developed in recent years in response to severe droughts. The aim is to provide greater clarity and certainty to all water entitlement-holders during water shortages and to improve the transparency and accountability of system operators.

4.4.1 Bulk entitlements for regulated systems

Clarifying source bulk entitlements

Source bulk entitlements cover the majority of supplies in regulated systems. They provide for a share of storage capacity and inflows and the right to take water from specified points in the system. At the time they were finalised, it was not thought necessary to set out how 'dead storage' (the water held in the bottom of storages that is below the normal outlet level) should be shared. However, in recent years it has been necessary to pump the dead storage of some reservoirs to meet critical human needs.

Pumping dead storage affects water availability to entitlement-holders in the following year, because inflows are required to replace the dead storage before water can be released from the normal outlets. This may have several consequences including:

- delaying water supply in the following year
- reducing the volume supplied in the following year
- stopping flows downstream of the storage.

Setting out the water-sharing and cost-sharing arrangements for supplying water above and below the minimum operating level of storages will help to manage potential competition during times of scarcity, and allow for more effective planning.

It should be noted that as a drought response in 2007, the operating level of the Waranga Basin was lowered by the installation of pumps. In this example, dead storage is considered to be below the minimum operating level with the pumps in place.

Policy 4.3: Principles to guide access to dead storage

- a) Water corporations will plan to access water below the normal minimum operating level of storages ('dead storage') only to supply critical human needs during times of water shortages, with consideration of third party impacts.
- b) The cost of supplying dead storage will be borne by the customers being supplied with the water consistent with the bulk entitlement.



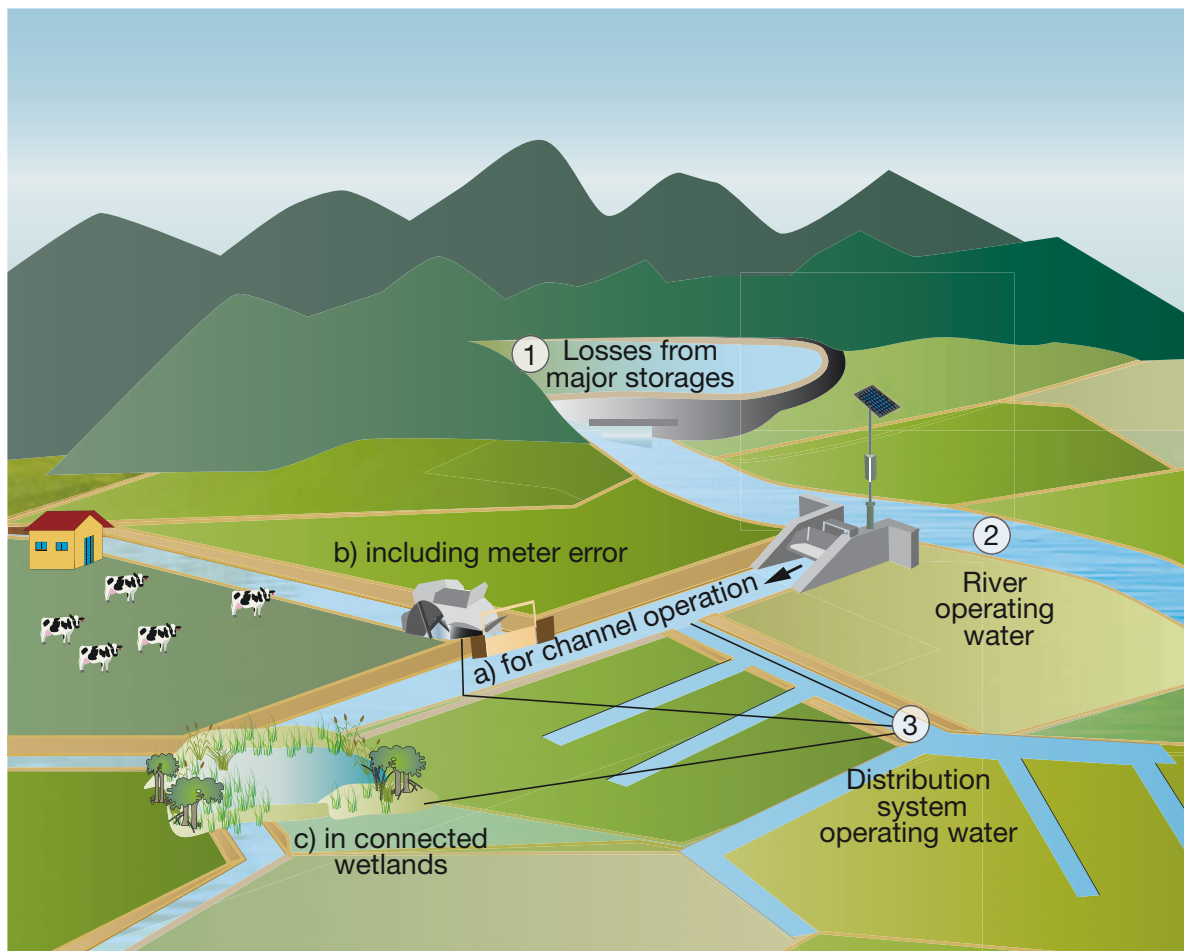
Cardross Lakes

Photographer: Bob Merlin, Mallee Catchment Management Authority

Source bulk entitlements for regulated systems include the water needed to operate the system for customers. Figure 4.4 illustrates the three components of 'system operating water' which are:

1. Storage losses, including water lost to evaporation, seepage and spills from the major storages in Victoria.
2. River operating water, used to operate regulated rivers (in accordance with bulk entitlements) and deliver water to off-take points for distribution systems, including evaporation, seepage and water to provide passing flows for riparian rights and maintain environmental and other assets.
3. Distribution system operating water, used to operate the irrigation distribution system from the river off-take to the farm gate, including evaporation, seepage, leakage, outfalls and meter error. Some water may also be used to maintain environmental assets that are part of the distribution system (for example, in the Torrumbarry system).

Figure 4.4 Components of system operating water



In all cases, bulk entitlements include the water necessary to operate the system. System operating water is included implicitly in older bulk entitlements and explicitly in more recent bulk entitlements. Updating older bulk entitlements to explicitly quantify and account for distribution system operating water enables the system operator to be accountable for the efficient operation of the system. It also allows for incentives to improve efficiency.

Explicitly defining distribution system operating water allows water savings (from modernisation – see page 119) to be quantified, ensuring they do not impact on other entitlements, particularly water shares. It also allows any temporary savings from system operation changes, such as closing down a channel as a drought contingency measure, to be identified and potentially allocated to entitlement-holders.

Explicitly quantifying distribution system operating water in bulk entitlements means this water can be progressively allocated on a pro-rata basis to distribution system operators. This provides more flexibility for operators to implement special operating arrangements to save water during extreme water shortages. For example, in recent drought years, Lower Murray Water and Goulburn-Murray Water were able to operate their system differently to meet the needs of their respective customers. These decisions should be made in close consultation with customers and announced as soon as possible to provide certainty for entitlement-holders. See page 96 for guidelines on shortening the irrigation season if there is insufficient system operating water.

The system operator's primary role is to deliver water to its customers in an efficient and effective manner. When improving efficiency, the system operator must supply water to entitlement-holders and meet any environmental obligations specified in the bulk entitlement or other management arrangement. See www.ourwater.vic.gov.au/programs/irrigation-renewal for more information, including the *Water Savings Framework for NVIRP*.

Action 4.15: Amending source bulk entitlements

Who: Department of Sustainability and Environment; water corporations

Timeframe: 2011

The following amendments will be made to improve source bulk entitlements:

- a) Following a review of source bulk entitlements, the water-sharing and cost-sharing arrangements for accessing dead storage will be specified as appropriate.
- b) Distribution system operating water will be quantified and separated from entitlement water (which is delivered to water share-holders). The system operator will be required to operate the system within this allocation.
- c) Distribution system operating water will be progressively allocated as it becomes available.
- d) The potential for water savings in river operating water will be assessed, including consideration of environmental impacts.

Delivery bulk entitlements

For towns supplied from the regulated systems, urban water corporations generally hold delivery bulk entitlements. These provide a volume of water each year, subject to defined restrictions during declared water shortages. These entitlements could be improved to enable the urban water corporations to better manage town supplies, particularly during droughts.

For example, the Minister for Water was required to qualify rights to allow for carryover (see page 98) as a drought contingency action for delivery bulk entitlement-holders on the Murray, Goulburn, Broken, Campaspe and Loddon systems. Permanently amending the entitlements to include carryover would provide more security and clarification for entitlement-holders.

Delivery bulk entitlements were issued before the unbundling of water rights into water shares, delivery shares and water-use licences and clarifying access to delivery channels would ensure these entitlements are consistent with the operation of irrigation systems.

Urban entitlements on the regulated Murray, Loddon and Campaspe systems are amalgamated into one primary entitlement for each water corporation. However, on the regulated Goulburn system, Goulburn Valley Water and Coliban Water each hold a number of delivery bulk entitlements that have details on annual volumes and daily extraction rates for a specified point. Provided this does not impact on other users or the environment, amalgamating these into one entitlement for each water corporation would:

- enable them to manage the resource as a whole
- allow them to transfer water between supply points
- encourage better commercial decisions around improving system efficiency.

Action 4.16: Amending delivery bulk entitlements

Who: Department of Sustainability and Environment; urban water corporations

Timeframe: 2011

Where required, delivery bulk entitlements will be amended to:

- ensure consistency of entitlements in the unbundled world
- provide one amalgamated entitlement for each water corporation in a trading zone.

The ability to carry over water without the need to qualify rights will be facilitated by amending the *Water Act 1989*.



Sheep drinking trough, Tamleugh

Photographer: Bruce Cumming

4.4.2 Bulk entitlements for unregulated systems

Some urban water corporations hold source bulk entitlements to take water from unregulated streams. These generally include an obligation to provide passing flows and a requirement to stop taking water when streamflows fall below minimum levels. In some cases, these requirements are different from the rules to restrict extraction by Section 51 licence-holders (see page 69). These inconsistencies can favour the right of one user over another.

In recent years it has been necessary for the Minister for Water to declare a water shortage and qualify rights on some unregulated streams in order to meet critical human needs (see page 11). In doing this, the water corporations, catchment management authorities and the Department of Sustainability and Environment have worked closely together to determine flow-sharing arrangements which provide for both critical human and environmental needs. Two broad approaches have been adopted, depending on local circumstances.

The first is to temporarily qualify rights by reducing the amount of water released from the storage to provide for passing flow obligations. This approach is generally applied where the water system relies on on-stream storages (for regulated systems) such as Maryborough's supply from the Loddon system. Generally, the consequences of reduced passing flows on downstream water users are mitigated by a range of measures such as:

- requiring a portion of the passing flows to be released as flushing flows
- requiring the quality of downstream refuge pools to be monitored and water released from stored passing flows if predetermined triggers are hit
- carting water.

The preferred approach is to avoid qualifying rights by revising bulk entitlements to allow pumping at higher rates during wet periods of low environmental stress, generally winter, to be stored for use in dry periods with high environmental stress. This approach is appropriate where town supplies are provided by pumping streamflows into off-stream storages, such as Mansfield. Neither the existing passing flow requirements nor the total amount of water able to be taken are changed, but the diversion rate during winter is increased.

Several issues need to be considered before implementing either approach, including:

- demonstrable need to meet critical human needs
- no increase in annual entitlement volume
- adequate modelling of the hydrological regime of the system
- adequate modelling of the consumptive requirements of its customers
- mitigation of impacts on the environment and consumptive users in the system.

Action 4.17: Amending bulk entitlements for unregulated systems

Who: Department of Sustainability and Environment; urban water corporations

Timeframe: 2011

Where required to ensure critical human needs can be met, bulk entitlements for unregulated systems will be amended to allow additional water extraction to an off-stream storage during wet periods. This will be allowed provided a number of conditions are met to demonstrate need and protect the environment and other water users in the system.



Bogong High Plains

Photographer: Alison Pouliot

4.5 Environmental water reserve (EWR)

The various components of the environmental water reserve (EWR) are described on page 10 and are discussed in more detail in the following section.

4.5.1 Environmental entitlements

Some environmental entitlements have the same characteristics as consumptive entitlements; environmental managers receive seasonal allocations and can call this water out of storage as they need it, just as irrigators do. Other environmental entitlements have special rules governing the allocation and use of water (for example, the rules-based environmental allocations for the Barmah Forest). Where possible, it is desirable for environmental entitlements to have the same attributes as other consumptive entitlements. This gives environmental managers the flexibility to maximise environmental benefits. It also means the risk of climate change is better shared across all entitlement-holders.

However, it is not always possible to create environmental entitlements with similar properties to consumptive entitlements; at least, not without changing the reliability of the environmental water and affecting existing entitlement-holders. In these cases, it is necessary to create more 'rules-based entitlements' that reflect the characteristics of the environmental water.

In some cases, specific watering regimes may be needed to efficiently meet environmental objectives. For example, large floods may be required every five years rather than annually. It may be possible to provide additional flexibility to environmental entitlements to meet these needs without adverse impacts on other entitlement-holders.

Creating entitlements from existing environmental water

As outlined in the *Murray-Darling Basin Agreement*, the Murray-Darling Basin Authority may declare a period of surplus flows when a number of conditions are met, including:

- commitments to South Australia (1,850 GL/year) have been met for a specified period of time
- consumptive demands of Victoria and New South Wales have been met
- there is insufficient capacity to divert or store these surplus flows in Lake Victoria.

Surplus flows can be opportunistically diverted for consumptive use in New South Wales. These flows could be available in years when it is not possible to make allocations for low-reliability water shares, for example, if the surplus flows result from a flash flood that cannot be captured in storage. However, as use of these surplus flows is accounted for under the Murray-Darling Basin Cap, they could reduce reliability for low-reliability water shares. To protect these shares, Victoria gave up its right to use surplus flows for consumptive use, which offered an opportunity to provide them to the environment.

Historically, Victoria has used some of its excess flows to provide public benefits within Victoria before agreeing to declare a period of surplus flow. For example, water has been provided to create flooding in Gunbower Forest, water river red gums and for recreation in Lake Boga. This water comes from Victoria's share of Murray resources as currently set out in the *Murray-Darling Basin Agreement*. Converting this water to an environmental entitlement will provide certainty for the environmental manager that the water that has been used for the environment in the past can still be utilised when it is available. Such water is likely to be available far less frequently under climate change. When it is available, it will be used for environmental and recreational purposes at places such as Hattah Lakes, Gunbower Forest, Lake Boga and for watering river red gum floodplains.

Policy 4.4: Properties of environmental entitlements

Where possible, new environmental entitlements will be defined in a way that is consistent with consumptive entitlements, including with seasonal allocations based on a share of the resource and the ability to call water out of storage and use it when and where it is needed.

Environmental entitlements will be tailored to meet environmental objectives where possible. This will only be done where there are no undue third party impacts including on existing entitlement-holders and the operation of the water market.

Consistent with the recommendations in the draft Murray Bulk Entitlement *Sharing the Murray*⁴⁶, the entitlement will have a maximum volume of 40 GL and will recognise the current opportunistic characteristics of the water (that is, it is available only when other commitments have been met and there is insufficient capacity to store the water). It will not provide for water to be called out of storage and allocations will not be tradeable. Use of the entitlement is not accounted for under the Murray-Darling Basin Cap.

The use of water arising from this entitlement will take into account the requirements of the integrated environmental management of the River Murray. Victoria will continue to work co-operatively with the Murray-Darling Basin Authority to optimise the whole-of-river benefits generated from Victorian environmental entitlements, and determining priorities for the use of surplus flows.

4.5.2 Environmental obligations on bulk entitlements

Water corporations release passing flows out of storages to operate river and distribution systems to provide for riparian rights and to maintain environmental values and other community benefits. These passing flows can be separated into river operating water and distribution system operating water (see page 71).

The volume of passing flows set aside purely for the environment is not clear in most bulk entitlements. It may be possible to differentiate the distribution system operating water intended purely to provide

environmental benefit (for example, where passing flow requirements include some level of seasonal variability). Where possible, this will be converted to environmental entitlements to provide environmental managers with greater flexibility to control when and how releases occur. This will only be done if the resulting environmental entitlement has the same reliability as the existing passing flows and there is no impact on other entitlement-holders. Where it is not possible to separate out distribution system operating water intended for the environment, it will remain an obligation on the bulk entitlement, recognising that it provides for a range of environmental, consumptive and other benefits (including river and distribution system operation).

Passing flow requirements are largely protected from the impacts of climate change because in most cases, these flows must be provided before water can be allocated for use. However, some bulk entitlements specify that passing flows are reduced or stopped when inflows are below a certain level. This reduction will become more common with climate change. Technical analysis is required to determine if passing flows could be redefined to maximise environmental benefit or better share the risk of climate change, without impacts on water users. In particular, the following bulk entitlements will be assessed:

- *Bulk Entitlement (Campaspe System - Goulburn Murray Water) Conversion Order 2000*
- *Bulk Entitlement (Eildon - Goulburn Weir) Conversion Order 1995*
- *Bulk Entitlement (Loddon River - Environmental Reserve) Order 2005.*

Action 4.18: Creating an environmental entitlement from unregulated flows on the Murray

Who: Department of Sustainability and Environment

Timeframe: 2011

An environmental entitlement will be created to give legal recognition to unregulated flows that are available after consumptive demands have been met and before a period of surplus flows is declared.

The entitlement will have a maximum volume of 40 GL, will recognise the current opportunistic characteristics of the water and will not be callable or tradable. The use of the entitlement will not be accounted for under the Murray-Darling Basin Cap.

Action 4.19: Passing flows for the environment

Who: Department of Sustainability and Environment; catchment management authorities

Timeframe: 2011

Where distribution system operating water is clearly intended for environmental benefit, it will be quantified in bulk entitlements and converted to environmental entitlements to provide the environmental manager with increased flexibility.

Where possible, passing flows will be redefined to better share the future risk of climate change provided there are no undue third party impacts.

Barmah-Millewa Environmental Water Allocation

The Barmah-Millewa Forest Environmental Water Allocation is seen as a priority entitlement for redefinition. This water provides for the large floods necessary to maintain key species (including river red gums and colonial water birds) in this Living Murray icon site.

The operating rules for the Barmah allocation allow up to 700 GL of water to be stored in Lake Hume until it is released for the Barmah-Millewa Forest. When allocations of high-reliability water shares are less than 100 per cent, the stored water can be borrowed to increase allocations. The borrowed water has to be paid back when allocations reach 100 per cent. The rules also enable the environmental manager to bring forward up to 50 GL of the following year's allocation to complete a watering event.

The 'borrow and payback' arrangements of this allocation mean it is susceptible to the impacts of climate change. With reduced water availability, there would be more years with less than 100 per cent allocations, resulting in more years where water users are borrowing the Barmah water and fewer years where it is able to be used for forest watering. It would also mean delayed payback. With climate change, this allocation will not be shared between consumption and the environment as originally intended.

In implementing this action, there will be no change to the balance between consumptive use and the environment provided by the original sharing rules over the historic record – but they will be amended to better share the risk of climate change. The Department of Sustainability and Environment will undertake hydrological modelling to investigate options to redefine the triggers for water allocation, borrow and payback and assess the impacts of these.

Use of the Barmah-Millewa Environmental Water Allocation is governed by the *Barmah-Millewa Environmental Watering Plan*. The development and review of the watering plan in Victoria is the responsibility of the Goulburn Broken Catchment Management Authority, in consultation with the public land manager. Consultation will also occur with the Yorta Yorta Joint Body in accordance with the Yorta Yorta Co-operative Management Agreement. The Victorian Government has recently made a commitment to establish a board of management for the Barmah National Park comprising a majority Traditional Owner membership. Once established, this board will also be consulted on the environmental watering plan⁴⁷.

Action 4.20: Barmah-Millewa Environmental Water Allocation

Who: Department of Sustainability and Environment; Goulburn Broken Catchment Management Authority; Goulburn-Murray Water **Timeframe:** 2012

To better share the risk of reduced water availability in the future, the triggers for water allocation, borrow and payback for the Barmah-Millewa Environmental Water Allocation will be redefined. This will be done in consultation with Goulburn-Murray Water and Goulburn Broken Catchment Management Authority, and subject to agreement by the Ministerial Council.

80 GL flood release from Eildon

The environmental manager may call for the release of up to 80 GL of environmental water when inflows to Lake Eildon exceed triggers set out in the Goulburn Bulk Entitlement. This environmental water is non-tradeable because it is largely re-regulated at Goulburn weir.

The trigger for release of these flows has been exceeded only once in the past 13 years. Under most scenarios considered in the Strategy, these triggers are even less likely to be met in the future. At the time that the trigger was exceeded, it was not possible to release the flows due to the risk of flooding private property.

In order for this water to provide some environmental benefit when the trigger is exceeded in the future, it is necessary to develop a clear watering and monitoring plan. The plan will outline the environmental benefits that could be achieved with optimal use of this water in conjunction with other existing or planned environmental entitlements.

In developing the watering plan, the Goulburn-Broken Catchment Management Authority will need to consider the risk of flooding private land. The *Water Act 1989* does not indemnify environmental managers and system operators from damage which may arise from intentional or negligent conduct resulting in flooding private land. This means there will need to be appropriate mitigation measures in place to prevent the flooding of private land. This will be informed by a study, currently in progress, to assess the potential extent of Goulburn floodplain watering.

Once the catchment management authority is clear on how the water would be used, it may be possible to redefine the entitlement rules around its release to increase the environmental benefits.

4.6.3 Charges for management of the EWR

When the EWR was established through *Our Water Our Future* in 2004, policy was developed regarding appropriate charges for its management, including headworks and delivery charges. This policy recognised that:

- the primary purpose of water supply infrastructure is to supply firm, reliable entitlements for consumptive users
- generally environmental entitlements can be managed with more flexibility than consumptive entitlements and therefore the environment can be provided with different levels of service to irrigators and other consumptive users
- water authorities have a duty to manage water resources in a sustainable manner and minimise adverse environmental impacts of their activities.

The costs of environmental watering actions are substantial. As with any water user there are annual fees attached, including headworks charges and delivery charges (such as costs of using irrigation infrastructure, or the cost of pumping water to a specific location). The current costs of environmental watering are funded in Victoria through the Environmental Contribution Levy. As water recovery programs are realised throughout the Murray-Darling Basin, costs of environmental watering will increase.

Action 4.21: Goulburn 80 GL flood release

Who: Department of Sustainability and Environment; Goulburn Broken Catchment Management Authority; Goulburn-Murray Water **Timeframe:** 2011

To maximise the environmental benefit of the 80 GL flows from Lake Eildon, an environmental watering plan will be developed and the entitlement reviewed. The risk of flooding private property will be assessed and mitigated.

Headworks charges

Water shares have ongoing costs associated with the storage of water, known as ‘headworks charges’. Environmental entitlements that have similar properties to water shares (that is, they provide a share of the available resource, are tradeable, can be held in storage and called out as needed) will also have these ongoing costs. There are two key mechanisms that would produce environmental entitlements of this type: modernisation projects (see page 113) and water purchase (see page 45).

The current policy states that “where the manager of the EWR holds a tradeable entitlement which is the same as a consumptive entitlement, in general, the manager will pay the same headworks costs as other users except where there is significant government investment in recovering water for the environment. In these cases, the headworks charges may be varied to take into account the full range of benefits and costs associated with the investment”⁴⁸.

The application of this policy has depended on the method of water recovery. For example, the environmental manager will not pay headworks charges for the environmental entitlements to be created from NVIRP Stage 1. This is consistent with other water saving projects where environmental water has been recovered through government investment (such as the Wimmera-Mallee Pipeline, Northern Mallee Pipeline, Snowy River, Macalister Irrigation District and the Thomson River). In these cases, existing users have paid the headworks charges and received the benefit of improved water delivery infrastructure and water savings.

In another example, the environmental manager pays the same charges as water share-holders for the environmental entitlements created through the ‘sales deal’. The sales deal was based on a clarification of rights to water, rather than significant investment in water recovery. In return for legal and tradeable low-reliability water shares, water users allowed 20 per cent of sales water to be reallocated to the environment.

Where the State or Commonwealth Governments invest in purchasing water entitlements for the environment, it is appropriate that they pay the associated headworks charges. Those charges are currently being met by individual irrigators (water share-holders) and if the Commonwealth Government did not continue to pay these charges, costs would increase for the remaining users.

Policy 4.5: Headworks charges for new environmental entitlements

The following principles will apply when the Commonwealth (or any) Government invests in water recovery for the environment:

- a) Where environmental entitlements result from water purchase, the purchaser will pay the associated headworks charges in full.
- b) Where environmental entitlements result from water savings projects, any headworks charges will be consistent with the above policy.

Delivery access and charges

Through the ‘unbundling’ of water rights entitlement-holders were provided with delivery shares. These shares effectively allocate a portion of the available delivery capacity in irrigation distribution systems. They help manage competing needs, such as when several users want more water at the same time than a congested system can distribute.

Environmental managers do not currently hold delivery shares. This effectively means they are treated as ‘casual users’. Casual users are generally irrigators who do not own delivery shares and pay a fee to access the distribution system when there is spare capacity. As such, casual users are provided a lower priority than those holding delivery shares. With increasing water scarcity, more active trade and improved system efficiencies, spare channel capacity could well be reduced leaving environmental entitlements at risk of being ‘squeezed out’ of the system. In order to manage this risk and ensure environmental water can be delivered through irrigation distribution systems when it is needed, environmental managers would need to secure delivery shares or have some other mechanism to ensure their needs are prioritised appropriately.

In assessing the priority of access, the environmental manager will need to consider the environmental value of the site and the flexibility in timing of water delivery. Some high-value sites may be suitable for watering at times when demand by irrigators is very low. In these instances, delivery shares would likely be unnecessary. Granting delivery shares to the environment will mean the environmental manager will need to take on the associated operating costs.

There are no explicit delivery shares allocated to manage congestion in natural waterways outside of irrigation distribution systems, but there are implied shares which provide for delivery of an individual's full entitlement over 100 days. As the CEWH and VEWH hold more environmental entitlements, this could change the traditional delivery pattern, resulting in increased congestion. Access rights will need to be clarified and a process established to ration the available capacity. It is appropriate that where natural waterways are used, the environmental manager is given a reasonable share of capacity at no charge.

Existing policy developed through *Our Water Our Future* provides a basis for determining the access rights and appropriate charges to be paid. The following action aims to build on this policy and to clarify the arrangements and associated costs that would apply.

Action 4.22: Rights to delivery capacity in irrigation distribution systems

Who: Catchment management authorities; rural water corporations

Timeframe: 2011

Environmental managers will advise rural water corporations of environmental sites which may require water delivery via the irrigation distribution system. The environmental manager will need to consider delivery priorities (depending on the degree of flexibility in timing of delivery) and the appropriate access options for each site, including:

- delivery shares for high priority sites where there is little flexibility in timing of delivery (allowing access equal to other delivery share-holders)
- casual use access for medium priority sites (allowing access equal to other casual users)
- ‘interruptible’ access for low priority sites where there is a high level of flexibility in timing of delivery (allowing access after casual users’ needs have been met).

Policy 4.6: Charges for environmental water delivery in irrigation distribution systems

The following charges will be paid when environmental water is delivered through the irrigation distribution system:

- a) Where the environmental manager holds delivery shares, they will pay the same charges as other delivery share-holders.
- b) Where the environmental manager relies on casual use access, they will pay the same charges as other casual users.
- c) In recognition of the public good benefits of environmental watering and the environmental obligations of the system operator, the environmental manager will be provided with 'interruptible' access (see Action 4.22) and will only pay the out-of-pocket costs, except in natural waterways in distribution systems, where there will be no charge.

Policy 4.7: Charges for environmental water delivery in natural waterways outside of distribution systems

In natural waterways outside of distribution systems, environmental managers will have access to a reasonable share of capacity at no charge. 'Reasonable' may be defined, at a minimum, as the existing access rights provided by the entitlement, plus access to any spare capacity.

Action 4.23: Rights to delivery capacity in natural waterways outside of distribution systems

Who: Department of Sustainability and Environment

Timeframe: 2011

Where the use of environmental water will change the historical delivery pattern and there will be congestion in natural waterways outside of distribution systems, a process will be developed to manage rationing. This process will take account of existing patterns of delivery and the delivery capacity rights provided by the relevant entitlements.



Channel, Irymple

Photographer: Bob Merlin, Mallee Catchment Management Authority

4.6 Use of return flows

Another way to maximise the productive or environmental outcomes of entitlements is to allow return flows to be used again downstream or traded by entitlement-holders. Return flows are the portion of an entitlement-holder's allocation that is returned to the bulk supply system. This could be outfalls from urban sewage treatment plants or return flows after environmental watering events. These arrangements do not apply to rules-based entitlements, such as the Barmah-Millewa Environmental Water Allocation.

"We support this important reform to acknowledge the value of return flows, which provides the appropriate market signals to inform both current operating decisions and future investment decisions."

– Draft Strategy submission DS076

Victoria's current entitlement framework generally does not include return flows in estimates of the amount of water available to be allocated. In most cases, return flows reduce the amount of water required to operate regulated rivers and provide additional flows in unregulated rivers. Users supplied by the bulk system benefit from this arrangement because it allows additional water to be allocated from the shared resource.

In contrast, entitlement-holders lose ownership of water they return to the waterway. There are currently no opportunities to reuse these flows. Allowing return flows to be reused provides individuals with increased choice and flexibility from which to make improved management and investment decisions. It does this by:

- giving entitlement-holders the option to use the supply system to reuse or supply return flows to a third party downstream (that is, use the river as a pipeline)
- enabling environmental managers to use return flows at multiple sites along a river.

This will facilitate the movement of return flows to their highest value use and therefore is an important

element in supporting regional development and improved environmental benefits, even with reduced water availability. For example, in assessing how to best utilise treated effluent, water corporations may find that transferring it to a willing buyer downstream provides the greatest net benefit for the organisation and local community when compared against other reuse options such as construction of a third pipe scheme. An example of how environmental managers will benefit from this policy is provided on page 140.

The incidental benefits for users supplied by the bulk system will be removed when individual entitlement-holders reuse or trade their return flows. However the nature of the existing entitlement is the principal consideration. Most of Victoria's bulk water entitlements include rights to take or store a gross volume of water from a specified location. This means that entitlement-holders are not obliged to provide return flows and therefore can use all of the water they are entitled to take from the system. Placing an obligation on an entitlement-holder to return flows would be detrimental because it would reduce any incentive to use the water more efficiently.

One way of facilitating the use or trade of return flows is by crediting the volume of returns against the entitlement-holder's water account. Although not suitable in all cases, such as on unregulated systems, a properly managed credit model is the simplest way of allocating returns.

To ensure material third party impacts are mitigated, it is appropriate that return flows are only reused or traded under certain circumstances. If not properly managed and accounted for, there is potential for return flows to be of poor quality and to have a negative impact on the operation of the water system. It is also necessary to ensure return flows are allocated and traded in line with Victoria's trading rules and within the Murray-Darling Basin Cap, which seek to prevent adverse impacts on other water users and the environment.

Policy 4.8: Reuse of return flows

Entitlement-holders will be allowed to reuse or trade their return flows downstream provided:

- there is adequate rigour in the calculation and/or measurement of return flows
- the return flows meet relevant quality standards*
- additional losses (if any) are taken into account
- the entitlement-holder of the return flows has obtained agreement from the relevant system operator
- the return flows can be delivered in line with timing requirements of the downstream user, purchaser or environmental site
- the system operator can re-regulate the return flows downstream, with a known and immaterial spill risk, if the entitlement-holder is requesting credits on a regulated system.

* See page 144 for policy regarding the water quality of environmental return flows.

While it may be possible for private diverters and water share-holders to reuse return flows (that is, irrigation drainage water), this is unlikely to occur because:

- returns from irrigation districts are already collected in water corporation infrastructure and allocated through supplies by agreement (see page 10)
- the poor quality of the return flows, sporadic availability of flows and difficulties in measuring their volumes would mean that individuals would need to treat and meter their returns at a high financial cost.

The Department of Sustainability and Environment will continue to work with water corporations, the Environment Protection Authority Victoria and Department of Human Services to develop appropriate processes to implement the return flows policy.

Action 4.24: Implementation of reuse of return flows policy

Who: Department of Sustainability and Environment; water corporations; Environment Protection Authority Victoria and Department of Human Services

Timeframe: 2010

Develop appropriate processes and rules to implement the return flows policy. A pilot project to develop the appropriate allocation, accounting and operational rules for return flows from North East Water's West Wodonga treatment plant will be undertaken.

5

This chapter outlines actions to improve certainty that entitlement-holders' water can be delivered when needed, with flexibility to match supplies with their water needs.



Certainty and flexibility for entitlement-holders

Guide to the chapter

Section 5.1 Operating the distribution system in all years

- Amending the reserve policy
- Shortening the irrigation season
- Final allocation date

Section 5.2 Carryover

- Limitations of the existing carryover rules
- Reviewing the carryover rules
- Introducing spillable water accounts
- Implementation issues to resolve
- Groundwater carryover

Section 5.3 Water trading

- Principles to guide trading rules
- Changes to major trading rules
- Other improvements to trading rules

What is the issue with the existing arrangements?

With reduced water availability, it is more difficult for entitlement-holders to meet their water needs. Urban water corporations may not be able to meet critical human needs; irrigators may have insufficient allocations to water their crops; environmental allocations may be inadequate to protect refuges for important plant and animal populations. Existing arrangements provide some protection – reserves are set aside so that distribution systems can be operated in dry years and processes exist that allow entitlement-holders to buy, sell and carry water over. However, recent years have demonstrated that these processes need to be improved to provide additional flexibility and certainty.

What improvements does the Strategy make?

- 💧 System reserves will be increased to enable available water to be delivered when and where it is needed, even during severe droughts. This allows entitlement-holders to always access risk management tools such as trade and carryover.
- 💧 Innovative carryover arrangements will be introduced to reduce the risk of entitlement-holders losing their water in average or wet years. This creates additional incentives and increases the usefulness of carryover in all climatic conditions.
- 💧 Trade rules will become more flexible to ease current limitations on entitlement-holders who wish to buy and sell their entitlements. Key changes relate to the four per cent limit, 10 per cent limit and trade in unregulated systems.

As outlined in Chapter 2, climate change and variability are the most significant risks to water resources. Climate change could result in a number of years where regulated rivers and irrigation distribution systems cannot be run for the whole season to deliver water to users (see Background Report 5). This would make trade and carryover ineffective for managing water availability in drought years.

Many enterprises in the irrigation districts require continuous water supplies. A year where no water can be delivered would write-off substantial investment. Towns that receive water via regulated systems and irrigation distribution systems would need to cart water to supply critical human needs, as would many domestic and stock customers. A lack of water could also place important plant and animal populations at risk in the wetlands connected to distribution systems.

As the region faces the prospect of its thirteenth year of drought, arrangements need to be in place to deal with these possibilities. This chapter seeks to improve certainty for entitlement-holders by being clear about how water is allocated and how distribution systems operate in average and drought conditions. But the main aim is to change system reserve policies and set aside water earlier in the year to ensure these systems can always be operated. This will allow entitlement-holders to get their water delivered when they need it.

With this certainty, the rules governing carryover and trade can be improved to increase flexibility for entitlement-holders to manage the risk of variable water availability. Trade and carryover are the key tools, and the actions in this chapter will provide more choice in how they can be used, while still preventing impacts on other people or the environment.

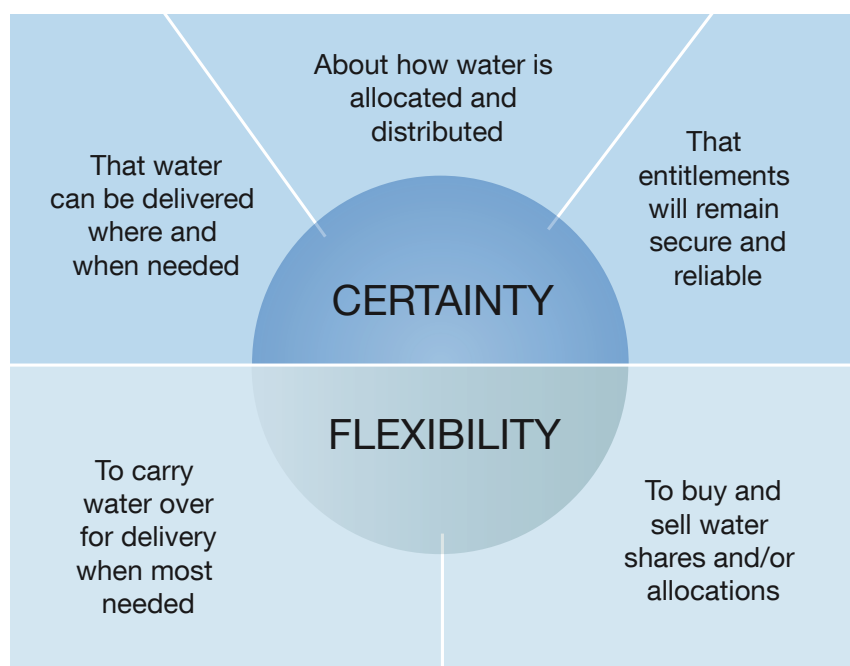
“... future allocation frameworks must provide security for future investment... the risk of zero allocations, where trade and carryover become ineffective risk management tools, is completely untenable.”

– Draft Strategy submission DS108

Figure 5.1 summarises the certainty and flexibility provided by the Strategy, including the importance of protecting the reliability and tenure of entitlements. This is discussed in Chapters 3 and 4.

It is important that the key changes are effectively communicated to entitlement-holders. General information will be available from the Department of Sustainability and Environment. More specific information about the reserve policy, carryover and trade for individual farm businesses will be communicated through Goulburn-Murray Water, the Department of Primary Industries’ regional extension programs and through industry service providers.

Figure 5.1 How does the Strategy provide certainty and flexibility?



5.1 Operating the distribution system in all years

The distribution system is the series of large storages and the river and channel network used to deliver water to users and the environment. Before they can receive their water, there must be sufficient water to operate the system; in other words, to cover evaporation and seepage, provide passing flow and so on (see page 71 for further discussion of 'system operating water').

In recent years, the consequences of being unable to fully operate the distribution system have become clear. If there is insufficient water to do so, no allocation can be made to entitlement-holders; carryover water cannot be delivered at all times; little water is available for irrigation; and there can be no effective water market. Zero allocation years effectively eliminate the normal risk management tools available to water users.

For some domestic and stock customers, it has been necessary to cart water, which is an expensive and time-consuming exercise. There are insufficient tankers in Australia to cart water to all domestic and stock customers in the Goulburn-Murray Irrigation District⁴⁹. Fortunately this has not been necessary due to contingency actions taken by Goulburn-Murray Water, including:

- only operating some channels such as those that provide urban supplies
- only operating channels part of the time
- reducing environmental flows (this requires a qualification of rights – see page 11)
- pumping dead storage (see page 71).

While necessary at the time, these contingencies introduce inequity and uncertainty for some entitlement-holders and it is preferable if they can be avoided. The following section outlines actions to increase the likelihood of operating the distribution system in all years without the need for contingencies. Operation of the system in all years is fundamental for water users across northern Victoria to provide certainty that the water an individual holds can be delivered when it is needed.

5.1.1 Amending the reserve policy

Bulk entitlements contain rules to calculate resource availability and allocate it or keep it in reserve for the following year; these 'system reserve policies' manage year-to-year variability and determine the volume and reliability of water supplied by the entitlement. Rule changes could significantly impact the entitlement value; therefore, this is only possible through the processes set out in the *Water Act 1989* which are designed to protect the integrity of the water shares supplied by these bulk entitlements.

Generally, water is allocated according to the following hierarchy:

1. Water set aside to cover operation of the major storages, river and distribution system (system operating water) for the full irrigation season.
2. Allocations of up to 100 per cent to high-reliability water shares.
3. Water held in reserve to ensure the following season's high-reliability water shares can be fully allocated, with sufficient system operating water for it to be delivered.
4. Allocations to low-reliability water shares for the current season.

This policy, which has evolved over the past 100 years, had been successful because it ensured distribution systems could be run every year and that 100 per cent allocations were available in about 96 years out of 100. This reliability underpinned the growth of high-value irrigated agriculture in northern Victoria.

However, the experience of the past 12 years, and the predicted impact of climate change, suggests that this policy may no longer be effective. Chapter 2 shows that with reduced water availability under medium climate change (Scenario B) or a continuation of the recent low inflows (Scenario D), there could be several years with zero allocations for the entire year. Amending the reserve policy can help to:

- address the risk of zero allocation years and improve the reliability of entitlements
- operate distribution systems for the full irrigation season, even in extreme drought years
- ensure the delivery of critical human needs and avoid the need to qualify rights
- increase early season allocations in dry years
- support an effective water market in dry years.

In line with the Strategy's guiding principles (see page 5), changes to the reserve policy aim to address the risks associated with the most severe climate scenario while avoiding unacceptable costs if this doesn't occur. Hydrological modelling was undertaken to assess the benefits and costs of amending the policy in the region's major river systems. To assess and compare the options, the following objective was used:

Where the benefits outweigh the costs, system reserves will aim to run the distribution system in all years (that is, provide for system operation, critical human needs and at least one per cent opening allocation in August).

A major problem with the current reserve policy is that no water is set aside in reserve until high-reliability water shares are fully allocated. In dry years there may be no reserve set aside, resulting in years where the distribution system cannot be run and no allocations made. Setting water aside in reserve before high-reliability water shares are fully allocated means reserves are set aside earlier, but the maximum volume of reserve is not increased.

Weighing up the costs and benefits

Setting reserves aside earlier provides insurance against drought and the potential impact of climate change. But there is a trade-off because system reserves effectively redistribute water between years; water is not allocated in one year and used for system operation and allocations in the following year. Using reserves to ensure there are no zero allocation years will generally mean a reduction in the frequency of full allocation years (see Figure 5.2). It is necessary to weigh this up against the need to deliver water in drought years.

The impact of reserve policy changes depends on the climate scenario used. Changing the reserve policy has little impact under the long-term average climate because there are few years with less than full allocations. This means there are few years when additional reserve is set aside and very few zero allocation years to be addressed. Under climate change, the risk of zero allocation years is greater and, as there are more years with less than full allocations, additional reserve is set aside more frequently. Ideally, system reserves would be set aside early enough to address the most severe climate change scenario, but in some systems the impact of reduced allocations in average or wet years could be unacceptable to entitlement-holders.

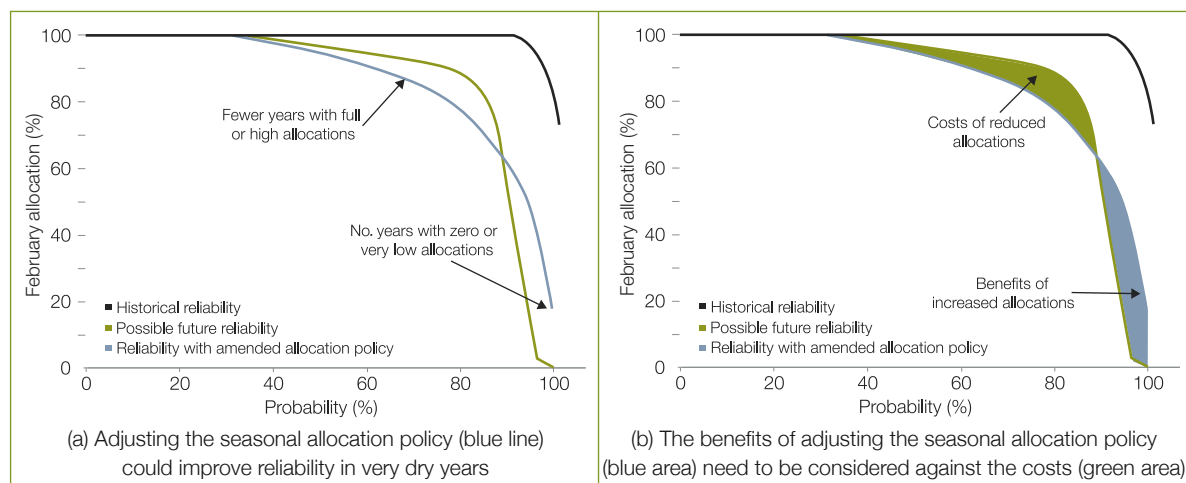
Changes will impact entitlement-holders differently. Each high-reliability water share holder will contribute the same proportion of their entitlement to reserve for the following year. Consultation feedback highlighted that the benefits are not as great for private diverters, whose water delivery relies only on operation of the river and not the irrigation districts. However, they will still benefit from higher opening allocations and better access to water trade. Equally important will be the establishment of a reserve for River Murray operations which will benefit private diverters and district irrigators (see page 92).

The appropriate reserve policy will vary between systems because each system is forecast to receive a different volume of inflows, has different system operating requirements and different entitlement to be allocated. In the Goulburn system, the change is highly effective and the cost is considered acceptable. In the Murray, it is less effective because river operating requirements are higher. Before implementation, agreement will be required to ensure the additional reserves set aside by Victorian water users will not supplement river operating commitments of other states.

In the Campaspe, the change could be effective, but the cost is high and customers do not support it. In the Loddon, no reserve policy is entirely effective and again customers do not support a change. Further information is required on the decommissioning of Lake Mokoan before reserves can be assessed in the Broken system. In partially regulated systems, such as the Ovens, or unregulated systems where there is no on-stream storage capacity, it is not possible to establish or improve reserves.

In systems where the reserve policy is amended, flexibility will be needed to adapt to changing conditions. For example, system operating and reserve requirements will be reduced as a result of modernisation (see page 113). Predictions of future water availability may be more reliable as a result of improved climate knowledge or updated modelling assumptions and this could also reduce the amount of reserves required. The Department of Sustainability and Environment and rural water corporations will reassess the reserve policy as required to ensure it still meets its stated objective. Any changes required will need to be approved by the Minister for Water.

Figure 5.2 Impact on reliability of supply from adjusting the system reserve policy (schematic only)



Note:

In terms of the volume of water delivered, the green and blue areas (cost and benefit respectively) are similar in volume, if not equal. See Tables 5.1 and 5.2 to compare the change in average annual diversions when the current allocation policy is amended to the preferred option under a range of water availability scenarios. Note that this schematic illustrates how reliability could change with an amended seasonal allocation policy. Actual modelling results can be found in the supporting background reports available from www.ourwater.vic.gov.au/programs/sws/northern.

The Draft Strategy explored the option of increasing system reserves by purchasing or resizing entitlements as an alternative to amending the reserve policy. These options are not preferred because they are less robust to a range of climate scenarios. If entitlements were purchased or resized based on a scenario that was too wet, it would be ineffective in protecting against zero allocation years. If it were based on a scenario that was too dry, entitlement-holders would have given up entitlement unnecessarily. See Background Report 5 for more information.

Goulburn system

In the Goulburn system, the reserve policy will be amended so that the risk of zero allocation years is addressed under all modelled climate scenarios, meeting the objective outlined on page 88. This change means that even under the most severe scenario (Scenario D), it will be possible to make opening allocations in August and run the distribution system for the full season in all years.

Up to 340 GL of water will be set aside in reserve before allocations for high-reliability water shares are made in full. This is equivalent to 20 per cent allocations plus the system operating water required to deliver it. The reserve will be used to operate the system and make allocations in the following season.

Table 5.1 outlines the impact of this change on reliability of supply. It shows that under the most severe scenario, the risk of zero August allocations in 11 years out of 100 is removed. Early season allocations are increased and the minimum February allocation is increased from zero to 10 per cent.

The cost is slightly fewer years of full allocations. With long-term average water availability, the frequency of full allocation years is reduced from 96 years out of 100 (under the old reserve policy) to 93 years out of 100 (under the new reserve policy). With the most severe climate scenario, full allocation years are reduced from 28 to 25 out of 100. The new policy does not significantly impact on total yield because the water that is held back from allocations is simply stored for use in the following season. The modelling shows that, with long-term average water availability, average annual diversions will be reduced by 3 GL, and under the most severe climate scenario, they will be reduced by 11 GL. In both cases, this is less than one per cent of diversions. This low cost, and the significant benefits, means this is a highly effective insurance policy. See Background Reports 5 and 6 for a comparison with other options investigated.

Note that there is no impact on low-reliability water shares because the maximum volume of reserve set aside in any year does not change. In other words, it is still necessary to set aside enough reserve to make full allocations for next season's high-reliability water shares before allocating low-reliability water shares in the current season.

Table 5.1 Impact of the new reserve policy on high-reliability water shares in the Goulburn system

Option	Indicator	Scenario		
		Base case (long-term average)	Scenario B (medium climate change at 2055)	Scenario D (continuation of recent low inflows, July 1997- June 2007)
Current policy (Use all resource improvement to start system reserve when allocations 100% for HRWS)	0% Aug allocation	0 years out of 100	2 years out of 100	11 years out of 100
	< 5% Aug allocation	0 years out of 100	4 years out of 100	18 years out of 100
	Min Feb allocation	27%	0%	0%
	< 30% Feb allocation	1 year out of 100	4 years out of 100	9 years out of 100
	100% Feb allocation	96 years out of 100	79 years out of 100	28 years out of 100
	Av. annual diversion (GL)	1,638	1,389	1,139
New policy (Use 1/2 resource improvement to start system reserve when allocations 30-50% for HRWS)	0% Aug allocation	0 years out of 100	0 years out of 100	0 years out of 100
	< 5% Aug allocation	0 years out of 100	0 years out of 100	2 years out of 100
	Min Feb allocation	35%	20%	10%
	< 30% Feb allocation	N/A	1 year out of 100	4 years out of 100
	100% Feb allocation	93 years out of 100	69 years out of 100	25 years out of 100
	Av. annual diversion (GL)	1,635	1,386	1,128

Action 5.1: System reserve policy for the Goulburn system

Who: Goulburn-Murray Water; Department of Sustainability and Environment

Timeframe: 2010

The system reserve policy for the Goulburn system will be amended in accordance with the following hierarchy:

- a) Water is set aside to operate the major storages, river and distribution system (system operating water) for the full irrigation season.
- b) Allocations are made to high-reliability water shares up to 30 per cent.
- c) After allocations reach 30 per cent, half the resource improvement is used to further increase allocations, with the other half set aside in reserve.
- d) After allocations reach 50 per cent, further resource improvement is dedicated to increasing allocations for high-reliability water shares up to 100 per cent.
- e) After high-reliability shares are fully allocated, water is set aside in reserve to ensure the following season's high-reliability water shares can be fully allocated and delivered.
- f) Allocations are made to low-reliability water shares for the current season.

During consultation on the Draft Strategy, many farmers expressed concern that water would be set aside in reserve instead of being used when allocations are only at 30 per cent. Experience in recent years has highlighted the difficulties faced by farmers and regional communities when allocations are low. Many submissions supported the idea of setting reserves aside earlier, but suggested this occur when allocations are higher than 30 per cent.

The reason this cannot be done is that putting aside water at higher allocations does not work under the most severe climate scenario. There is still a risk of zero allocation years, when carryover cannot be delivered, the water market cannot operate and domestic and stock needs cannot be supplied as normal. The rationale for setting aside reserve when allocations are at 30 per cent is that:

- water is not set aside in very dry years; there is no impact, only benefits, in years when allocations are less than 30 per cent
- when allocations are at 30 per cent, there is generally sufficient water for the water market to operate, which means individuals have a means of controlling their own supplies
- water is set aside in reserve early enough to meet the stated objectives and address the risk of zero-allocation years; waiting until allocations reached, for example, 50 per cent before putting aside reserve would not meet this objective.

Murray system

The analysis on the Murray was similar to that undertaken on the Goulburn system, however none of the options eliminated the risk of zero allocation years under Scenario D. Even so, changing the reserve policy does have some benefits, particularly when combined with other contingency actions. The number of years with zero starting allocations is reduced, and in dry years, starting allocations are increased. For the same reasons as the Goulburn system, 30 per cent is considered an appropriate allocation at which to start setting aside reserve. Setting aside reserves any earlier would come at a greater cost in average seasons without eliminating the risk of zero allocation years.

Up to 260 GL of water will be set aside in reserve before allocations for high-reliability water shares are made in full. This is equivalent to 20 per cent allocations plus the system operating water required to deliver it. The reserve will go to operating the system and making allocations in the following season.

Table 5.2 outlines the impact of this change on reliability of supply. It shows that under the most severe scenario, the risk of zero August allocations is reduced from 16 to 14 years out of 100. When combined with other actions, such as reducing the season length when necessary, this is reduced to five years out of 100. Without the change to the reserve policy, such measures alone would only be able to reduce the number of years with zero allocations in August by two years, from 16 to 14 years out of 100.

The cost of changing the reserve policy is slightly fewer years of full allocations. With long-term average water availability, the frequency of full allocation years is reduced from 98 years out of 100 (under the old reserve policy) to 97 years out of 100 (under the new reserve policy). With the most severe climate scenario, full allocation years are reduced from 68 to 63 out of 100. As with the Goulburn, water is only held back temporarily, so the new policy does not significantly impact on total yield. Modelling shows that, with long-term average water availability, average annual diversions are reduced by 2 GL and under the most severe climate scenario, they are reduced by 7 GL. In both cases, this is less than 0.5 per cent of diversions. Note that there is no impact on low-reliability water shares because the maximum volume of reserve set aside in any year does not change. See Background Reports 5 and 6 for a comparison with other options investigated.

Table 5.2 Impact of the new reserve policy on high-reliability water shares in the Murray system

Option	Indicator	Scenario		
		Base case (long-term average)	Scenario B (medium climate change at 2055)	Scenario D (continuation of recent low inflows, July 1997- June 2007)
Current policy (Use all resource improvement to start system reserve when allocations 100% for HRWS)	0% Aug allocation	1 year out of 100	6 years out of 100	16 years out of 100
	< 5% Aug allocation	1 year out of 100	7 years out of 100	17 years out of 100
	Min Feb allocation	71%	0%	0%
	< 30% Feb allocation	N/A	4 years out of 100	9 years out of 100
	100% Feb allocation	98 years out of 100	89 years out of 100	68 years out of 100
	Av. annual diversion (GL)	1,697	1,563	1,445
New policy (Use 1/2 resource improvement to start system reserve when allocations 30-50% for HRWS)	0% Aug allocation	0 years out of 100	5 years out of 100	14 years out of 100
	< 5% Aug allocation	0 years out of 100	5 years out of 100	15 years out of 100
	Min Feb allocation	73%	0%	0%
	< 30% Feb allocation	N/A	4 years out of 100	7 years out of 100
	100% Feb allocation	97 years out of 100	85 years out of 100	63 years out of 100
	Av. annual diversion (GL)	1,695	1,558	1,438

Action 5.2: System reserve policy for Victoria's Murray system

Who: Goulburn-Murray Water, Department of Sustainability and Environment

Timeframe: 2011*

The reserve policy for the Murray system will be amended in accordance with the following hierarchy:

- a) Water is set aside to operate the major storages, river and distribution system (system operating water) for the full irrigation season.
- b) Allocations are made to high-reliability water shares up to 30 per cent.
- c) After allocations reach 30 per cent, half the resource improvement is used to further increase allocations, with the other half set aside in reserve.
- d) After allocations reach 50 per cent, further resource improvement is dedicated to increasing allocations for high-reliability water shares up to 100 per cent.
- e) After high-reliability shares are fully allocated, water is set aside in reserve to ensure the following season's high-reliability water shares can be fully allocated and delivered.
- f) Allocations are made to low-reliability water shares for the current season.

Before implementation, interstate negotiations will need to ensure that the additional reserves set aside by Victorian entitlement-holders are quarantined from shared resources and sufficient contingencies are in place to guarantee River Murray operation (see page 46).

* Timing is dependent on interstate negotiations. Goulburn-Murray Water will advise customers on implementation timing as negotiations occur.

The risk of insufficient water to make an August allocation in five years out of 100 means that further action is needed to make this an effective policy. A changed reserve policy will not be as effective as with the Goulburn system, largely because more water is required to operate the River Murray where commitments include flows to South Australia. In very dry years, it is possible that existing interstate water-sharing rules will result in the reserves set aside by Victorian entitlement-holders being used to supply interstate entitlement-holders. This is clearly a major disincentive for Victorian Murray entitlement-holders to set reserves aside earlier. Any change to Victoria's Murray reserve policy will depend on Murray-Darling Basin Ministerial Council agreement that these reserves are held solely for the benefit of Victorian Murray water share-holders. An additional, shared reserve is required to ensure that the River Murray can be operated in all years (see page 46).



Pear picking, Orrvale

Photographer: Bruce Cumming

Two Murray reserves – what is the difference?

There is the potential for confusion over different ‘reserves’. A reserve is simply a store of water that has been put away for the following year, instead of being used in the current year. This could be for a variety of reasons. Victoria has always set aside reserves to support allocations to and delivery of high-reliability water shares, before allocating to low-reliability water shares.

With the dry conditions of the past 12 years, it has become apparent that more may be needed. This Strategy commits to setting reserves aside earlier to ensure that the Northern Region’s irrigation distribution systems can be operated in all years – even under the most severe climate scenario (see page 88). As discussed in Chapter 3, the Strategy also recommends that the Basin states consider setting aside additional reserves to ensure that the River Murray can be operated in all years. The following table highlights the differences between these two reserves.

	Northern Region system reserves (see Actions 5.1 and 5.2)	Shared River Murray reserve (see Action 3.3)
Who?	In line with bulk entitlements, Goulburn-Murray Water manages system reserves. Water for additional reserves comes from and benefits Victorian entitlement-holders.	In line with the <i>Murray-Darling Basin Agreement</i> , the Murray-Darling Basin Authority is responsible for operating the River Murray. Water for additional reserves must be agreed by, comes from and benefits Victoria, New South Wales and South Australia.
Why?	This reserve aims to ensure that irrigation distribution systems in the Northern Region can be run for the entire season in all years. Operating the distribution system is critical for carryover and trade to be effective risk management tools.	This reserve would aim to ensure that the River Murray can be run in all years. This is necessary for water to be delivered for critical human needs. A reserve would avoid the need for ad hoc interstate sharing arrangements. It also supports the Northern Region system reserve on the Murray – water cannot be delivered to the distribution systems if the river is not running.

Campaspe system

Since the release of the Draft Strategy, reserve options for the Campaspe system have been modelled, but following consultation with Campaspe stakeholders, a change to the reserve policy is not supported.

The modelling showed reserves could be used to address the risk of zero allocation years. Under the most severe climate scenario, instead of having 21 years out of 100 with no allocation in August, there would be none. However, this comes at a significant cost. From zero to 100 per cent allocations, it would require half of all resource improvement to be put in reserve, while the other half would be used to increase allocations. Up to 56 GL more water would be set aside in reserve before allocations for high-reliability water shares are fully allocated. This reserve would go to operating the system and making allocations in the following season. With water being stored for longer, there is more evaporation and this would reduce total yield by an average of two to 10 per cent a year.

These results were discussed with the Strategy’s Consultative Committee, working groups, Goulburn-Murray Water’s Rochester-Campaspe Water Services Committee and Campaspe Catchment Committee. In addition, a letter was sent to all Goulburn-Murray Water Campaspe customers. Feedback from all of this consultation confirmed that a change to the reserve policy is not supported by the Department of Sustainability and Environment, Goulburn-Murray Water or its customers at this time. It was generally felt that the cost of lower allocations in good years (by setting aside additional reserves) was too great. See Background Report 5 for more detailed modelling results.

The future water needs of the Campaspe Irrigation District will be reviewed and the most cost-effective and beneficial options assessed as part of NVIRP (see page 114).

Loddon system

Since the release of the Draft Strategy, reserve options for the Loddon system have been modelled. Similar to the Campaspe system, a change to the reserve policy is not supported at this time.

The most extreme option was setting half of all resource improvement aside in reserve from zero allocations right up to 100 per cent. The other half would go to increasing allocations. Under this option, it was also assumed that no supplementary supplies were provided to the Goulburn system. Essentially, the modelling results showed that even this extremely conservative reserve policy did not address the risk of zero allocation years. Under the most severe climate scenario, there are 34 years out of 100 with zero August allocations. The most conservative option only reduced this to 20 years out of 100. See Background Report 5 for more detailed modelling results.

These modelling results were discussed with the Strategy's Consultative Committee, working groups and Goulburn-Murray Water's Loddon Catchment Committee. Feedback from this consultation confirmed that a change to the reserve policy is not supported by the Department of Sustainability and Environment, Goulburn-Murray Water or its customers at this time.

Some customers have found alternative solutions to manage through drought years, including:

- conjunctive surface and groundwater use
- investment in annual/opportunistic crops or dryland enterprises
- on-farm storage for domestic and stock needs.

Broken system

Under its *Our Water Our Future* initiative, in 2004 the Victorian Government committed to decommissioning Lake Mokoan, an inefficient storage with high evaporation rates on the Broken system. Since then, the Department of Sustainability and Environment has been working with affected water users to finalise the operational details of this project and ensure that reliability of supply will not be impacted. The effectiveness of changing the reserve policy on the Broken system could vary depending on how this project is implemented. Therefore, reserve options on the Broken will be assessed and discussed with entitlement-holders after implementation details of the Lake Mokoan project are finalised (expected by late 2009).

Ovens system

Because the Ovens system is largely unregulated, it is not possible to store water for system reserve. Water availability for entitlement-holders is governed by restrictions and bans rather than a reserve policy. See page 62 for more information about management of unregulated systems.

Action 5.3: Assessing reserve policy options on the Broken system

Who: Department of Sustainability and Environment; Goulburn-Murray Water

Timeframe: 2010

Hydrological modelling will be undertaken to assess the effectiveness of changing the reserve policy on the Broken system to address the risk of zero allocation years. This will be done following finalisation of the implementation details for the Lake Mokoan project.

5.1.2 Shortening the irrigation season

Shortening the irrigation season reduces the amount of water required to operate the irrigation distribution system and this saved water could be used to enable the season to open on 15 August and to help make an opening irrigation allocation. River operations would continue as normal. Shortening the season by two months in 2007/08 (ending 15 March) saved about 130 GL of operating water, which was then used to support opening allocations in the same year of 15 per cent and five per cent respectively in the Goulburn and Murray systems. Inflows received during the season were used to ultimately achieve a full season.

Shortening the irrigation season enables distribution systems to operate, so that entitlement-holders can get their carryover or purchased water delivered. This Strategy aims to formalise a process to decide when and how the irrigation season can be shortened, rather than making ad hoc decisions in drought years. This will allow greater transparency, improve market certainty, and enable more informed planning for water users.

The objective is to ensure a full irrigation season in gravity districts in all seasons. This is the foundation of robust irrigation districts because it provides certainty to entitlement-holders that they can get their water delivered when needed. A full season is important to support the wide variety of farming enterprises that rely on the distribution system at different times of year.

The first step is to ensure the irrigation season opens on 15 August in all years. This is important for dairy farmers and graziers to provide water for pastures in the lead up to spring when they are most productive. For cropping farmers, it provides access to water at a time that allows crops to reach their full potential.

The next priority is to ensure a full irrigation season before allocations are raised. If allocations were increased before extending to a full season this would be at the expense of those who require water delivery at the end of the season. Certainty about how the irrigation season will be shortened (if required) allows individuals to plan their water supplies through actions such as carryover and trade, and ensures that water users in irrigation districts are not denied opportunities to manage their own water needs.

If, as in 2007/08, a full season is ultimately achieved, the cost for entitlement-holders of announcing a shorter season is uncertainty in deciding when during the season to use water. If a full season cannot be achieved, the cost is more real for district irrigators who would be unable to have water delivered in autumn. Private diverters, who pump directly from the river, will not be affected by this policy, and will continue to have access to their allocations or carryover for the full year. Improvement in allocations would benefit all irrigators, including private diverters, while the cost of the shortened season would impact on district irrigators.

Shortening the season will occur only as a contingency measure to enable irrigation districts to operate in a succession of dry years when system reserves are insufficient to allow a one per cent allocation. Note that changes to the reserve policy (Actions 5.1 and 5.2) are predicted to eliminate the need for this in the Goulburn system and reduce the need in the Murray.

It is important to note each of the affected water corporations will have flexibility to advise their customers of any effect on system operation, such as a shortened season or reduced levels of service, as they deem necessary until sufficient resources are available to fully operate the distribution system.

Policy 5.1: Shortening the irrigation season

The length of the irrigation season will be shortened only as a contingency action (in conjunction with Actions 5.1 and 5.2) to enable distribution systems to operate in extremely dry years. From the 2008/09 season, this will be done according to the following guidelines:

- a) Provided there are sufficient reserves, the irrigation season in gravity districts will always *start* on 15 August (1 July in pumped districts), with discretion for the water corporation to delay this in wet years when there is no demand to irrigate.
- b) The irrigation season in gravity districts will always *end* on 15 May, however when there is insufficient resource to operate the distribution systems for a full season, water corporations will announce an earlier end date to help meet the objective of operating the system with a one per cent opening allocation in August.
- c) If it is necessary to shorten the irrigation season, water corporations will announce this as soon as possible to provide certainty for entitlement-holders.
- d) If an early end date is announced (to enable the system to be operated with a one per cent allocation in August), further resource improvement will be used first to extend the season to full length before improving allocations.

5.1.3 Final allocation date

Traditionally, allocation announcements have been made up to the end of April. However, in recent years, final allocation announcements have been brought forward to the start of April. Any inflows that occur after this time have been put aside for system operations and allocations in the following season.

Allocating all resource improvement after 1 April to operating the system in the coming year will provide certainty to entitlement-holders for their late season water use and carryover planning. It adds additional assurance that there will be sufficient water to operate the system in the following year.

This date was brought forward from the Draft Strategy proposal of 15 April as a result of the decision to allocate all resource improvements after 1 April 2009 to build reserves for system operations in 2009/10. This decision was made in response to the risk of having insufficient water to operate the River Murray in 2009/10, given the low inflows being experienced and the very low volumes of water in storage.

In exceptionally wet times when system operating requirements for the following year are fully covered, the resource manager could decide to announce allocation increases after 1 April. Historically, increases in allocations after March are rare. With the recent low inflows, the biggest reductions in seasonal rainfall have occurred in autumn and winter, resulting in the loss of the autumn break. If this trend continues, it is even less likely that there will be late season improvements to allocations.

Policy 5.2: Final allocation date

Final allocations will be announced on 1 April to provide certainty to entitlement-holders for their late season water use and carryover planning. All resource improvement after 1 April will be dedicated to operating the system in the coming year. Where sufficient reserves are already established for the following year, the resource manager may decide to announce allocation increases after 1 April.



Fruit for sale

Photographer: Bruce Cumming

5.2 Carryover

Carryover was introduced in northern Victoria in 2006/07 as an emergency drought response measure. It allows individuals to keep their unused water allocation in the storages for use in the following season. It is available to holders of high and low-reliability water shares, both of which provide a right to inflows and storage capacity. Carryover is a tool to redistribute water between years that enables individuals to manage their own reserves – and their own risk. It encourages the efficient use of water by giving entitlement-holders more flexibility to use their water when it is of greatest value to them.

Carryover is a particularly important tool in low allocation years because, provided the distribution system is operational, it provides water at the beginning of the season when seasonal allocations may be low. It can also offer more certainty about the minimum volume of water available in any season. Together with trade, which allows water to be redistributed between users, carryover gives individuals greater control over their own water supplies.

For horticulturists, carryover provides a way to guarantee that water will be available at crucial crop times such as fruit set and bud set. For dairy farmers and graziers, it helps to ensure that irrigation can occur in spring when the highest growth responses to water are likely to occur. For cropping farmers, it ensures that crops can realise their production potential by having adequate water in spring.

Urban water corporations can use carryover to help avoid severe water restrictions. This reduces the need to qualify rights to water (see page 11), a benefit for all entitlement-holders. Carryover also gives environmental managers the opportunity to store water for release early in the season when it is most needed for survival flows during droughts or for high flows and floods (see page 147).

5.2.1 Limitations of the existing carryover rules

Under existing carryover rules, the volume of water available to an entitlement-holder in any year is limited to 100 per cent of their entitlement (that is, an individual's carryover plus allocations cannot exceed 100 per cent). This rule is in place to prevent individuals from using more storage capacity than they are entitled to. Without it, carryover could affect the reliability of other entitlements in wet years (see Figure 5.3).

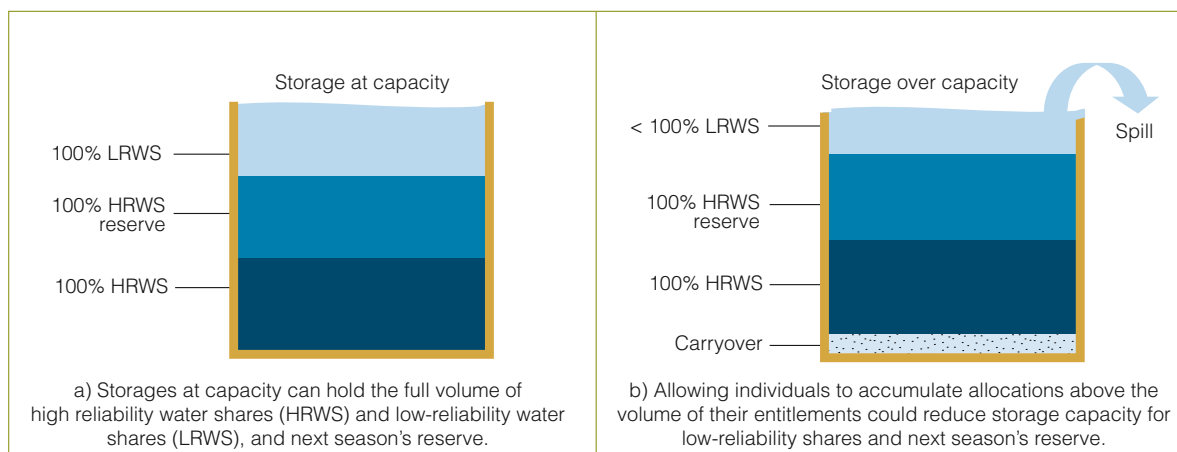
While there is good reason for the 100 per cent rule, it means entitlement-holders who carry over water will miss out on allocations in average and wet years when there are full allocations. In essence, the existing rules work well as year-by-year insurance to help manage through dry years. However, they are not so useful in average to wet years, when entitlement-holders would miss out on allocations due to the 100 per cent rule. In addition, an individual that wishes to accumulate allocations over several years to meet larger demands is unable to do so, even when storages are at low levels and storage capacity is not constrained. This is a particular disadvantage for environmental managers, but also for mixed farmers who do not necessarily irrigate every year.

“Carryover limitations should be liberalised as much as workable with as few penalties as possible... Penalties need only apply if the storages are actually spilt caused by the carryover.”

– Draft Strategy submission DS152

Another limitation of existing carryover rules is the 50 per cent rule where entitlement-holders can only carry over up to 50 per cent of the volume of their high and low-reliability water shares. This limit was raised from 30 per cent in February 2009, as proposed in the Draft Strategy. The rule was initially intended to limit the impact of carryover on the reserve pool and therefore, other entitlement-holders.

Figure 5.3 Potential impact of carryover without the 100 per cent rule



Before the introduction of carryover, unused water was returned to the reserve pool to be reallocated to all entitlement-holders. Now that water can be carried over, the amount of unused water going to the reserve pool could be reduced, resulting in potentially lower seasonal allocations. Limiting the maximum amount that could be carried over was designed to limit the potential magnitude of this impact.

However, as we are approaching full utilisation of water and the value of water is increasing, there is less unused water at the end of a season. This is particularly the case in dry years when almost all water will be used unless individuals consciously choose to save it for carryover. This means that raising the 50 per cent rule and allowing individuals to carry over up to their entitlement volume would have minimal impact, and it would allow individuals maximum flexibility to manage their own risk.

5.2.2 Reviewing the carryover rules

When carryover arrangements were made a permanent option for entitlement-holders in December 2007 it was intended that the effectiveness of the rules would be reviewed when allocations reached 80 per cent on either the Goulburn or the Murray systems. Given the uncertainty of when this would occur, it was proposed that the review should be conducted through the Northern Region Sustainable Water Strategy. The Draft Strategy proposed that the review should be finalised in time for the 2010/11 season.

Objective of the carryover review

The objective of the review is to provide maximum flexibility and certainty to entitlement-holders, while preventing third party impacts. Entitlement-holders should have access to the tools to manage the risks associated with variable water availability. This should be done at minimal cost to the individual and their decisions should not be allowed to adversely impact on third parties, including other entitlement-holders and the environment. The costs and risks of carryover should be clear and explicit, allowing individuals to make informed decisions. Rules should be simple, and consistent across systems where practical.

Principles underpinning the carryover review

1. **Water allocated to an entitlement-holder belongs to them.** Provided it does not impact on third parties, entitlement-holders should not be limited in carrying water over.
2. **All entitlements that allow water to be kept in storage have the right to carry water over.** This includes both high and low-reliability water shares, since they are both legally recognised entitlements with a right to a share of inflows and a share of storage capacity. It includes environmental entitlements that have similar characteristics to consumptive entitlements (for example, the Murray

Flora and Fauna Bulk Entitlement) but not rules-based environmental entitlements (for example, Goulburn 80GL flood release).

3. **The storages at capacity are fully utilised to support existing entitlements, assuming average usage levels.** This means that when the storages are full, individuals cannot store more than the volume of their entitlement as this would impact on reliability of supply for other users.
4. **Water carried over, like seasonal allocation, should be tradeable.** Carryover should not impose unnecessary barriers to water being traded to its highest value use, whether environmental, economic or social.

Consultation on the carryover review

In late 2007, a working group was established to review the operation of carryover, with membership from irrigation and environment interest groups, rural and urban water corporations and catchment management authorities. The group made recommendations that led to the Minister for Water's announcement that carryover arrangements would be ongoing from 2007/08 as a permanent option for entitlement-holders. As part of these arrangements, it was intended that the rules would be reviewed when allocations reached 80 per cent on either the Goulburn or the Murray systems.

Further work was undertaken by the Northern Region Sustainable Water Strategy working groups, one of which was an expansion of the original carryover group. A proposal paper was released in March 2009 for further consultation through Goulburn-Murray Water and Lower Murray Water's customer committees and grower groups. Through this consultation, community members offered a range of views on the carryover proposal. There was particular support for reducing the risk of individuals unnecessarily losing their water when storage levels are low, and many noted that the changes would see carryover being used as more than a drought response mechanism.

The carryover review focused on overcoming the limitations of initial rules and maximising the flexibility and benefit of carryover. More specifically, it explored ways to allow entitlement-holders to use available storage capacity to retain their water and only lose carryover if the storage physically spills, rather than limiting water users to their entitlement volume through the 100 per cent rule.

The outcome of the review allows entitlement-holders casual (that is, opportunistic) access to storage space while there is capacity in the dams. This gives more flexibility to irrigators, urban water corporations and environmental managers to manage their own water availability. Spillable water accounts (SWAs) are an innovative way to keep track of any casual access to storage to ensure that this water spills first when the dams are full. This protects existing entitlements to water and storage capacity.

5.2.3 Introducing spillable water accounts (SWAs)

The value of carryover as insurance against drought years cannot be denied, but its usefulness is limited in average and wet years. As described on page 98, the 100 per cent rule results in individuals missing out on allocations when allocations plus carryover reach 100 per cent. Carryover governed by spill rules reduces the risk of entitlement-holders losing their carryover in full allocation years, thereby making carryover a more useful tool in all years. If there is less risk of losing carryover in average or wet years, there is more incentive to invest in carryover as insurance against droughts.

SWAs enable accurate accounting of water held in storage above an individual's full entitlement volume while there is available capacity in the storage. This is critical for managing spill rules to protect the rights of existing entitlements to water.

Entitlement-holders' allocations, trade and water use are currently managed in their allocation bank accounts (ABAs), recorded in the Victorian Water Register (see page 11). All water in these ABAs is treated equally; it can be traded at any time, and used whenever delivery is possible. If entitlement-holders were allowed to store carryover water above the volume of their entitlement in their ABA, it would be very difficult to keep track of water that should spill from individual accounts when the storage physically spills. Individuals could use trade to get around spill rules, and adversely impact other entitlement-holders. Using a separate account, the SWA, to keep track of water that is casually occupying storage space ensures that this water is the first to spill when the storages physically spill.

Managing carryover with the SWA is similar to existing arrangements, except that once allocations plus carryover reach 100 per cent of entitlement volume, all further allocations are credited to the SWA rather than being lost to the entitlement-holder.

Water held in the SWA belongs to the entitlement-holder, but cannot be used unless there is minimal risk of storages spilling. It is lost to the entitlement-holder when there is no spare storage capacity available and storages physically spill. This condition retains the intent of the original 100 per cent rule; it ensures that carryover does not take up storage space that is allocated to and needed by other entitlement-holders. Without this condition, carryover could affect reliability of supply for other entitlement-holders.

Note that unlike previous carryover rules, there is no limit to how much water can be carried over.

Figure 5.4 provides an example of how the SWA might work for one entitlement-holder. Background Report 7 contains more detailed examples of how an irrigator may choose to use the SWA. Table 5.3 provides a simple comparison of the different characteristics of an ABA and SWA.



Cattle at feeder

Photographer: Allison Pouliot

Figure 5.4 A new concept – the spillable water account (SWA)

A practical example

1. An individual with a 100 ML entitlement carries 20 ML over from Season 1 to Season 2. This water is available in their allocation bank account (ABA) at the start of Season 2.
2. Allocations in Season 2 reach 80% and 80 ML is credited to the individual's ABA, to take the total to 100 ML, equal to their full entitlement volume.
3. There is a further seasonal improvement and allocations are increased to 100%. This additional 20 ML is credited to the individual's SWA.
4. Once the system operator declares that there is a very low risk of the storage spilling for the rest of the season, this 20 ML is transferred to the individual's ABA. It can now be used or traded. Until this declaration, the water remains in the SWA and cannot be accessed.
5. If the storage spills, water in the SWA is lost to the individual.
6. As water in the SWA is always either transferred to the ABA or spilled prior to the end of the season, carryover of all unused water in the ABA at the end of the season occurs automatically as it does now.

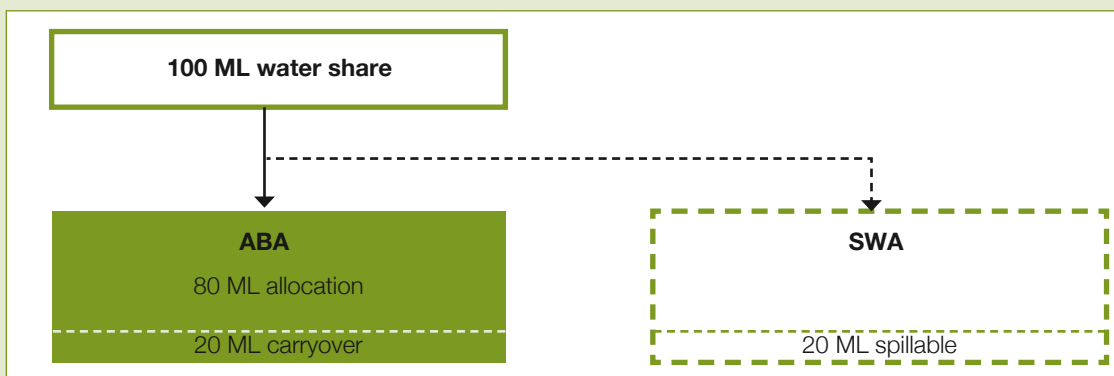


Table 5.3 Comparison of an allocation bank account (ABA) and a spillable water account (SWA)

Water held in an ABA:	Water held in an SWA:
i) Secure storage of seasonal allocations and carryover.	i) Casual (opportunistic) storage of additional water after carryover plus allocation in the ABA reaches 100%.
ii) Carryover plus allocations limited to entitlement volume (until water from SWA is transferred after it is declared there is a very low risk of spill).	ii) Not limited in volume.
iii) Available for use or trade at any time.	iii) Cannot be used until it is declared there is a very low risk of spill. It is then automatically transferred to ABA for use, trade or carryover at the end of the season.
iv) Cannot spill.	iv) Can be lost when storage physically spills.

Implications of the SWA for existing carryover rules

After the introduction of the SWA, there will no longer be a limit on how much water can be carried over. This will give more flexibility for all entitlement-holders – irrigators, urban water corporations, and environmental managers – to manage their own water availability. Some irrigators have told us that the current 50 per cent rule is sufficient to manage their risk; however removing this restriction will provide more options for irrigators to manage their supplies, such as accumulating their unused water in average years to be called upon in dry times. This would reduce dependence on the water market in difficult years.

Not limiting carryover is particularly important for the environment, allowing environmental managers to accumulate allocations over several years to provide intermittent flooding events. This will mean that the environment can meet their needs with less entitlement than they would require under the current rules. This will benefit irrigators, by reducing the amount of entitlement the environment needs to buy back out of production.

“The environment has significant variability in its annual demand for water and needs maximum flexibility in carryover to minimise entitlement volumes required to provide environmental outcomes.”

– Draft Strategy submission DS126

While the SWA reduces the risk of missing out on allocations for all entitlement-holders there is still value in allowing water to be carried over against low-reliability before high-reliability water shares. This reduces the need for many individuals to use SWAs, resulting in less water being ‘quarantined’ unnecessarily (that is, inaccessible until there is a very low risk of the storage spilling). This will increase the amount of water available for trade, helping to lower the market price of water. Having more water fully available for productive use increases the regional benefits from carryover and water resources more generally.

Action 5.4: Introducing new carryover rules

Who: Department of Sustainability and Environment

Timeframe: 2010

The following ongoing carryover rules will be introduced effective from the end of the 2009/10 irrigation season:

- a) Entitlement-holders can carry over any unused water in their ABA at the end of the season.
- b) Where an entitlement-holder has both high and low-reliability water shares linked to the same ABA, water carried over will be deemed to be recorded first against low-reliability water shares, then against high-reliability water shares.
- c) Carryover, up to entitlement volume, will be available in the ABA at the start of the following season. Carryover above entitlement volume will be held in a SWA.
- d) After allocation plus carryover reach 100 per cent of entitlement volume, all further allocations will be credited to their SWA, rather than being lost to the entitlement-holder.
- e) Water held in a SWA will be quarantined* until:
 - i) the system operator declares there is very low risk of the storage physically spilling; then the water will be transferred into the entitlement-holder’s ABA for use or trade
 - ii) the storage physically spills; then water in all SWAs will spill proportionally and entitlement-holders fully bear this risk
 - iii) there is a risk of the storage physically spilling; then water in the SWA continues to be quarantined until i) or ii) occurs.
- f) Five per cent of water carried over at the end of the season will be deducted to account for evaporation losses in the following year.

An implementation committee will be established to resolve any detailed implementation issues.

*Quarantined = set aside for the entitlement-holder but unavailable to them for use or trade.

5.2.4 Implementation issues to resolve

The SWA is a simple concept that enables carryover to be governed by spill rules. This improves the flexibility and benefit of carryover by reducing the risk of missing out on allocations in average and wet years.

However, there are several implementation issues still to be worked through (see Table 5.4) for which an implementation committee will be established. Committee representation will be similar to the original carryover working group and subsequent Strategy allocation working group.

Table 5.4 Key considerations in implementing the spillable water account (SWA)

Topic	Issues to resolve
Development of spill rules and declaration of 'very low risk of spill'	Further work will be undertaken to identify appropriate spill rules (that is, triggers to declare that there is a very low risk of spill and entitlement-holders can access water in their SWA). This decision will be based on storage levels, inflow forecasts and length of the season remaining. Access as early in the season as possible would benefit all entitlement-holders. In particular, it would enable the environmental manager to successfully complete winter/spring watering events. Early access is dependent on the level of risk accepted that there will not be a spill later in the season (which would then impact on all other entitlement-holders). Other issues to resolve include identifying the most appropriate storage(s) on which to base spill rules upon, and developing protocols to govern announcements by the system operator that the risk of spill has passed.
Suitability to smaller water systems	It is proposed that SWAs will apply on the Murray, Goulburn and Campaspe systems but further work is needed to assess suitability for smaller systems like the Broken and Loddon.
Development of appropriate tariff arrangements	In principle, if a user is casually accessing additional storage capacity, they should pay a tariff to contribute to the costs of operating and maintaining the storages. A range of tariff options will need to be assessed, including 'no change to existing tariffs'. Under each option, Goulburn-Murray Water's total revenue will not be increased.
Ensuring no material impact on reliability of supply	Managing carryover using the SWA is not considered to affect the reliability of supply, however further work will be undertaken to confirm this. If there is considered to be a material impact on reliability, appropriate mitigating measures will be developed before the SWA is implemented.
Trade between SWAs	Further work will be undertaken to investigate opportunities for trade between SWAs.

5.2.5 Groundwater carryover

Groundwater carryover will enable groundwater users to capture the benefits enjoyed by surface water users, who now consider carryover to be a vital part of their water management. Carryover will mean increased flexibility for licence-holders to manage their water resources when groundwater (and surface water) allocations are low. It is an alternative to trade for sourcing additional water.

Carryover will enable unused licensed allocations to be retained in individual accounts rather than being returned to the communal resource. However, this indirect impact will not reduce the total amount of water resource available. It is possible to allow carryover of groundwater where aquifer storage is large relative to annual licence entitlements, but it is not appropriate for all systems, especially for shallow aquifers that rely on yearly recharge to maintain storage levels.

Aquifers appropriate for carryover will need to be identified, including where:

- there is adequate data about the aquifer and likely responses to extraction
- the licensed bores in the area are metered
- there is enough volume in the aquifer to buffer levels against variable pumping rates from year to year
- third parties, including the environment, are not adversely impacted
- relevant management arrangements are in place (for example, PCVs and trigger levels).

An upper limit is required for the volume of water that can be carried over in a given system. The relevant rules will aim to increase flexibility for licence-holders without causing unacceptable third party impacts. In regulated river systems, storage capacity limits are clearly defined with associated spill rules, but it is not yet clear how similar rules could be developed for groundwater. Rather than calculating complex spill rules, groundwater users will be limited

initially to carrying over up to 50 per cent of their entitlement. This approach will be verified through local management rules to account for the specific storage characteristics of aquifers (see page 64). Over time the effectiveness of rules will be reviewed.

In surface water systems, water allocations, usage and carryover are all accounted for in the Victorian Water Register. Groundwater licences will be recorded in the register from September 2009, after which allocations and carryover for groundwater can be accounted for. The register will tell the licensing authority the total volume of carryover at the end of the season, and enable allocations for the following season to be calculated (that is, the resource available for allocation equals available water minus carryover water).

The introduction of carryover will not increase the average amount of water taken above the initial licensed volume, but it may change usage season by season (that is, water will have to be carried over before it can be taken). In addition, the extraction of groundwater from a bore may cause the draw down of the aquifer in a local area, otherwise known as bore interference. However, existing licence conditions should be sufficient to effectively manage the impacts of draw-down and other impacts to users and groundwater-dependent ecosystems; they place limits on the total amount that can be extracted over a year and pumping rates for a single bore. The introduction of carryover will not remove the need for licence-holders to comply with the pumping rate conditions of their licence. A licence-holder may apply to increase their pumping rate as a result of having access to carryover, but a decision to vary the pumping rate would need to take into account bore interference and environmental issues.

Action 5.5: Carryover rules for groundwater

Who: Department of Sustainability and Environment; rural water corporations

Timeframe: 2010

From 2010, the following carryover rules will be able to be introduced for Section 51 licence-holders in appropriate groundwater systems:

- a) Licence-holders will be able to carry over a maximum of 50 per cent of their entitlement. Local management rules may determine a lower percentage if appropriate.
- b) Five per cent will be deducted to recognise that through-flow into deeper aquifers or groundwater dependent ecosystems will reduce the volume of carryover water physically retained in the system in the following year.
- c) Carryover volumes may be transferred or traded.

Rules for carryover in specific aquifers will be determined through local management rules or a management plan. Where necessary the *Water Act 1989* will be amended to support groundwater carryover.

5.3 Water trading

A water market has existed in northern Victoria since 1991. Water trading is one of the most significant means for an individual to access additional supplies under the Murray-Darling Basin Cap on diversions (see page 11). It enables rural water users, urban water corporations and environmental managers to buy and sell water shares, seasonal allocations and Section 51 licences. While trading does not create new water, it does encourage more efficient use of water resources.

The water market is a fair and effective way to reallocate water to meet changing needs of individuals and the community in both the short and the long term. In times of water scarcity, it is a voluntary way to move water between uses. Without trade, irrigators could not buy additional water when allocations are too low to support their crops. Likewise, other irrigators could not sell their allocations to generate revenue.

“The water market has worked well, (especially this year as the market participants are gaining a better understanding of the situation) given the circumstances. The more intensive irrigators with viable businesses have been able to survive. The less intensive irrigators (water sellers) have fared better than they would have without trading.”

– Draft Strategy submission DS152

If the market did not exist, other compulsory and more bureaucratic methods would need to be found to reallocate water. This type of government intervention reduces people’s confidence in their entitlement and makes it harder for them to plan ahead. It is therefore important to ensure Victoria maintains the integrity of its entitlements so the community has confidence to invest. The high level of trade in 2007/08 demonstrates the importance of trade in a low allocation year (see Table 5.5).

In 2007/08, about 90 per cent of trade was undertaken by irrigators. The Commonwealth Government has committed \$3.1 billion over 10 years to purchase water entitlements for the environment and as such will become a more active market participant; this is discussed further in Chapter 3. Urban water corporations have also participated in water trading. However, as urban water use in the Northern Region accounts for only four per cent of total water use, it is generally felt that their participation is unlikely to cause any significant market distortion or community impacts. (Note that Melbourne Water cannot purchase water from northern Victoria but will be able to sell water in the future, with the expansion of the water grid).

Figure 5.5 outlines recent trends in the movement of water across the Northern Region, which suggest that horticulture ventures in the Sunraysia area are securing water shares, but selling some or all of the allocations back until they are required. The sale of water shares and allocations in other areas could reflect the retirement of salt-affected land (for example, in Pyramid-Boort and Shepparton). Victorians purchased a net average of about 16 GL of allocation per year from interstate and sold a total of 34 GL of water shares.

Table 5.5 Trade of high-reliability water shares[#] and allocations^{##} in 2007/08[^]

Supply system	High-reliability water share (GL)		Allocation				
	Entitlement	2007/08 transfer	2007/08 season %	2007/08 season GL	2006/07 carryover (GL)	Total available (GL)*	Trade (GL)
Broken	26.4	0.6 (2%)	71%	18.7	0	18.7	1.4 (8%)
Bullarook	0.8	0.02 (3%)	0%	0	0	0	0 (0%)
Campaspe	37.1	1.1 (3%)	18%	6.7	0	6.7	1.6 (24%)
Goulburn	990.1	76 (8%)	57%	564.4	18	582.4	219.9 (38%)
Loddon	21.7	1.1 (5%)	5%	1.1	0	1.1	0.4 (37%)
Murray	1185.8	78.7 (7%)	43%	509.9	110	619.9	132.3 (21%)
Ovens	26.5	0.5 (2%)	100%	26.5	0	26.5	1.6 (6%)
Total	2288.4	157.9 (7%)	-	1127.3	128	1255.3	402.1 (32%)**

Notes:

Previously known as permanent trade.

Previously known as temporary trade.

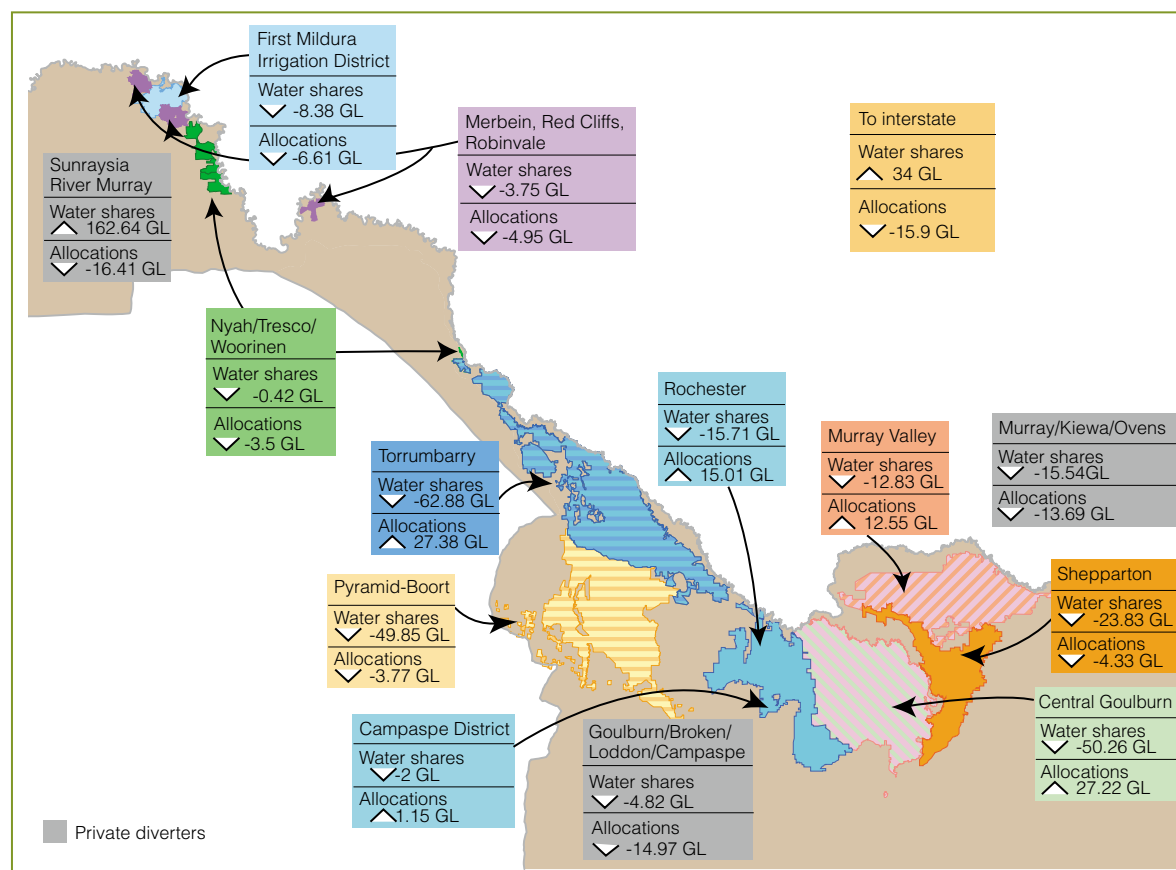
[^] At end June 2008.

* Trade is counted on the sellers side only.

** Does not include interstate inbound trade (72.3 GL).

Figure 5.5 Recent trends in the movement of water

Net trade of water shares[#] (1991/92 to 2007/08) and average trade of seasonal allocations^{##} (2001/02 to 2006/07) into and out of major irrigation districts in Northern Victoria, and interstate



Notes:
[#] Formerly 'permanent trade'.
^{##} Formerly 'temporary trade'.

The trade of water licences in unregulated river systems is not currently widespread (see Table 5.6). Trade of groundwater is also limited with about 12 GL being temporarily traded in 2007/08.

As water availability decreases, it is likely that licence-holders will want additional flexibility to trade their groundwater allocation and licences.

Table 5.6 Temporary trade in unregulated systems in 2007/08[#]

Trading zone	Volume traded (GL)*	Volume traded (as % of entitlement volume)
110 Goulburn unregulated	0.059	0.43%
130 Lower Goulburn unregulated	0.005	0.05%
160 Upper Murray unregulated	0.073	0.57%
180 Ovens and King unregulated	0.378	2.24%
191 Kiewa main stem unregulated	0.735	5.04%

Notes:
[#] Permanent trade statistics are not yet available on the water register, but will be following register upgrades.
 * Volume purchased.

Trade is a valuable tool to ensure that water can be moved between different users, and uses, to meet the changing needs of the community, but the associated adjustment issues must be acknowledged. As water moves around the region (refer to Figure 5.5), there are changes in the amount and type of irrigation that occurs in local areas. This affects local irrigation-dependent industries, businesses and ultimately population levels, unless alternative employment is found.

Water is not the only factor driving these changes and a strong, resilient community will adapt to them, provided it occurs at an acceptable rate and with appropriate support. This is discussed in Chapter 9. Chapter 3 discusses possible mitigating strategies to limit the adverse community impacts of the Commonwealth Government's \$3.1 billion water purchase. The remainder of this section outlines the key actions to improve the water market and encourage responsible trade in northern Victoria.

5.3.1 Principles to guide trading rules

Trading rules have evolved as the water market has developed over the past 15 years. These cover all aspects of an operational water market including how much water can be traded, who can trade, where water can be traded, the types of transactions that can be made and the types of products that can be traded. Continuing to improve the water market means building on the developments and rules already in place.

The principles that guide the development of trading rules include:

1. Trade from one trading zone to another is generally permitted if the traded water can readily flow to the destination trading zone (that is, if the water can be physically delivered).

2. Trade upstream, for example from the Murray into a tributary (that is, 'back-trade') cannot occur unless there has been previous trade the other way.
3. Trade should not damage the environment or heritage assets – for example, there are limits on trade through the Barmah Choke to avoid summer flooding in the Barmah-Millewa Forest.
4. Trade should not create impacts on third parties by eroding other people's entitlements or level of service – for example, trade from an unregulated system (where there is no guarantee that allocations can be taken) to a regulated system (where allocations once made are guaranteed) is only allowed as back-trade. However, trade should not be prevented where impacts on others are caused solely by increased utilisation of pre-existing 'sleeper' entitlements.

Any changes to trading rules need to be considered in light of these principles.

Trading rules for regulated systems are set out by the Minister for Water in the *Trading rules for declared water systems*, available from www.waterregister.vic.gov.au. The Victorian Water Register also provides information about trading rules and guidelines, the trading history of water shares and allocations, summary statistics and processing times. Trading rules for unregulated systems are published in the *Policies for Managing Take and Use Licences*. Within unregulated systems, trading rules can vary with local circumstances and specific risks. Some trading rules within unregulated systems will be reviewed to ensure there are no unnecessary restrictions (see page 110).

Recent agreements between the State and Commonwealth Governments will result in the Commonwealth Government playing a greater role in setting water market and trading rules. Chapter 3 provides information on the role of the Commonwealth in the Murray-Darling Basin.

Water brokers and trader rights

Regional media has heightened the concern of some community members about the behaviour of water brokers and exchanges. Some also raised this issue in their submission to the Draft Strategy. In particular, there is concern that some brokers are taking unwarranted commissions and inappropriately keeping interest earned on irrigator's money (when there are delays in trade approvals). As a result there have been calls for increased regulation of brokers and exchanges.

Water brokers or exchanges are regulated by the *Trade Practices Act 1974* (TPA 1974). They are required to meet certain legal obligations, separate from contractual or other rights and obligations that may occur with a customer. The TPA 1974, and similar legislation in each state and territory, states that businesses and individuals, including water brokers and exchanges, must not:

- engage in misleading or deceptive conduct

- make false or misleading representations
- accept payment if they are unable to deliver
- engage in unconscionable conduct
- use harassment or coercion.

Fair trading obligations also prohibit anti-competitive conduct, such as agreements or understandings with other brokers or exchanges regarding prices or who to deal with. The Australian Competition and Consumer Commission (ACCC) enforce the TPA 1974, and provide a range of useful advice and information to brokers and customers (see www.accc.gov.au).

To avoid potential problems, individuals wishing to buy or sell water should consider the advice given by the ACCC in its publications, check trading information on the Victorian Water Register and use a reputable broker or exchange.

5.3.2 Changes to major trading rules

Water trade in regulated systems in the Northern Region is well established. This section outlines two key changes to these rules to provide greater flexibility for individuals.

The four per cent limit

The trade of water shares (permanent trade) out of Victorian irrigation districts is currently limited to four per cent of a district's total high-reliability water shares per season. For example, in a district that has 100 GL of high-reliability water shares, only 4 GL can be traded out in any one season. The trade of water allocations (temporary trade) is not constrained by the four per cent limit.

The limit was designed to address the risk of 'stranded assets' where distribution infrastructure is left with fewer customers to pay for its maintenance. This risk has now been addressed by the creation of delivery shares and introduction of termination fees. The limit also manages the rate of community adjustment as water is traded out of local areas.

A key issue with the limit is that it can negatively impact on individuals who wish to sell their water shares. An irrigator in a district that has reached the four per cent limit will be restricted to selling within their district, where the price may be less.

The Commonwealth Government was concerned that the four per cent limit on trade would prevent it from implementing its \$3.1 billion purchase program (see page 45). The Victorian Government was concerned that an untargeted Commonwealth water purchase would severely affect communities resulting from trade out of highly productive areas.

On 4 June 2009, the Victorian and Commonwealth Governments agreed on better coordination of Commonwealth purchases with NVIRP. Under the agreement, and subject to a review of progress on the modernisation project, Victoria will begin to phase out the four per cent limit from July 2011, with a view to removing it entirely by 2014. In the meantime, the Commonwealth will be exempt from the four per cent limit where they purchase water from willing sellers in less productive areas. This allows the Commonwealth's purchase program to continue, while a phase out period allows communities time to adjust – a balanced outcome. Criteria have been agreed for the first round of exemptions which total 60 GL out of the Commonwealth's 2008/09 water tender (see page 117). The Commonwealth expects to purchase 460 GL from Victoria over the next five years.

The 10 per cent limit

Water entitlements are now separated from land. This means a person can own a water share without owning land. These arrangements were put into place in Victoria through unbundling. The legislation for unbundling enabled a limit to be placed on the amount of water shares that can be held by non-landholders or 'non-water users'. The initial limit was set at 10 per cent of water shares from each system.

In September 2009, legislation was passed which removed the 10 per cent 'non-water user limit'. The decision was reached after discussions at COAG and a government review responding to NWI commitments to ensure the limit did not become a barrier to trade.

While not yet an impediment to trade, once reached, the limit would mean that no more entitlement could be 'disassociated' from land. It would limit irrigators and other entitlement-holders who require additional flexibility by owning disassociated water shares. In addition, water purchases from outside irrigation districts, including interstate and Commonwealth environmental purchases, would be confined to the 10 per cent of entitlement that has already been dissociated. This limitation would ultimately hold back the value of 90 per cent of Victorian water entitlements.

5.3.3 Other improvements to trading rules

The water market provides entitlement-holders with a better chance of managing climate change and variability. When there are barriers to trade, for

example from restrictive trading rules or ineffective trading processes, entitlement-holders are less able to manage through dry years and droughts. Individuals are less able to buy and sell as they need to. Trading provides water users access to additional resources.

Action 5.6: Improvements to trading rules

Who: Department of Sustainability and Environment; water corporations

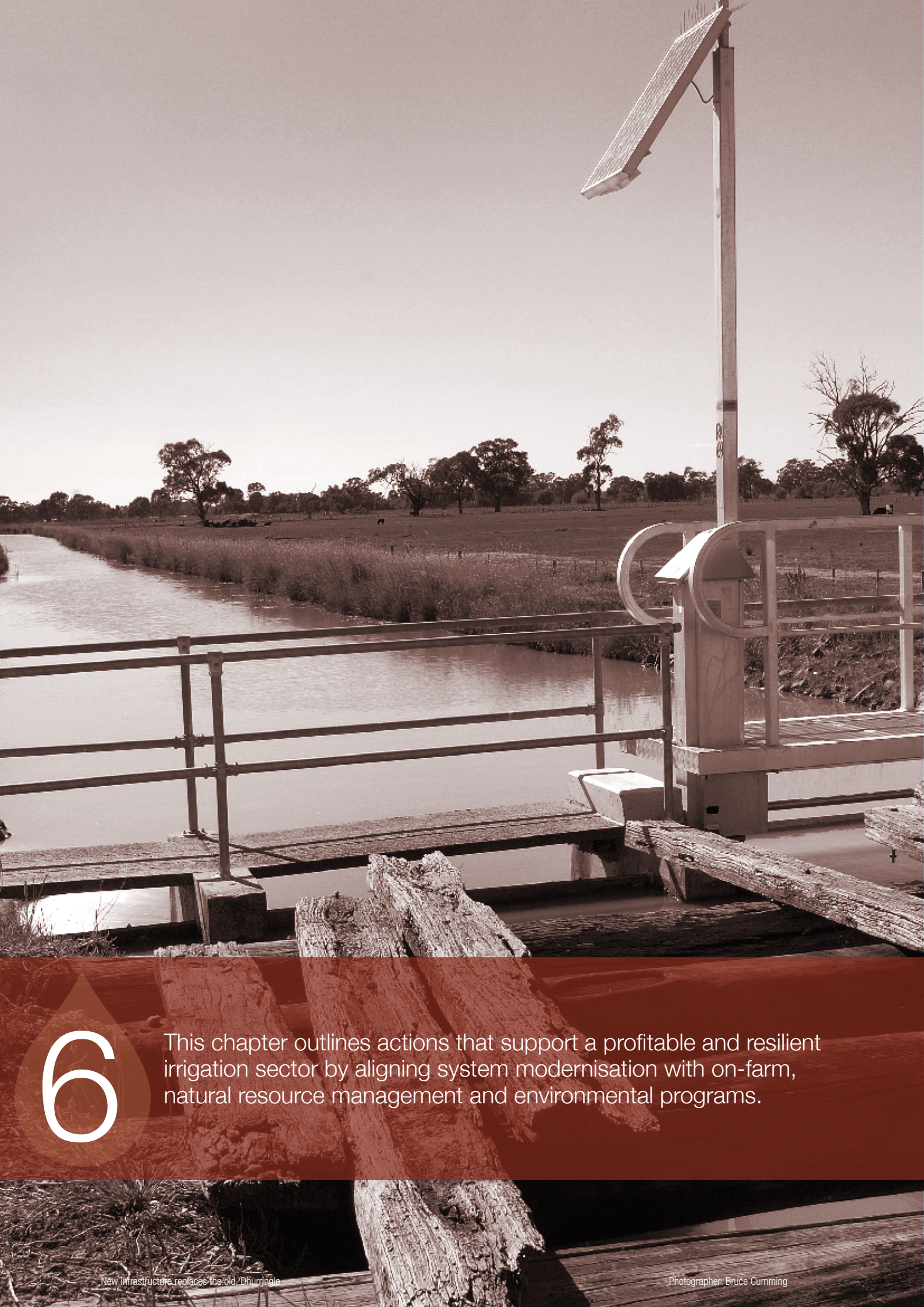
Timeframe: Various (see Table 5.7)

Trading rules will be improved to provide better opportunities and increased flexibility for entitlement-holders while preventing third party impacts. See Table 5.7 for a list of the specific issues to be actioned.

Table 5.7 Improvements to trading rules

Theme	Context	Action
Trade in regulated systems	Setting upper limits on trade Rivers have naturally low flows during summer, but this is when water users require water to be delivered on regulated systems. The unseasonally high flows in summer could have adverse environmental impacts.	Trading rules will be reviewed by 2012 to ensure that the delivery of water traded from the Goulburn system does not cause significant environmental damage to the lower Goulburn River. Similar analyses will occur for the Campaspe River, Broken River and Broken Creek if required.
	Trade in the Coliban and Broken systems The Goldfields Superpipe from the Goulburn system to Bendigo brings opportunities for increased trade in the Coliban channel system. Currently there is no water trade allowed out of the Broken system.	The possibility of allowing trade within and out of the Coliban channel system and trade out of the Broken system will be investigated by 2011.
	Barmah choke trading rules To avoid unseasonal summer flooding in the Barmah Forest, a Living Murray icon site, water trading through the Barmah Choke (a narrow section of the River Murray near the town of Barmah) is limited. However, in dry years, an exception could be made.	Victoria will work with the Murray-Darling Basin Authority to formalise the process for relaxing allocation trade through the Barmah Choke in dry years by July 2010.
	Leasing options Leasing, a limited term transfer of water (typically multi-year rather than seasonal), can offer more flexibility for people and the environmental manager in regulated systems to manage the risk of reduced water availability. As with any commercial arrangement, a lease between two parties is best formalised in a contract.	A checklist of items to include in a leasing contract will be made publicly available to assist those wishing to participate in leasing options by July 2010.
	Interstate trade Interstate trade will always be more complex, however processing times could be improved. Administration of interstate tagged entitlements could be more streamlined.	Victoria will work with New South Wales and South Australia to reduce approval times for interstate trade of allocations and to improve interstate trading processes by 2011.

Theme	Context	Action
Trade in unregulated systems	General trading rules and exceptions for unregulated trade	<p>Historically in unregulated systems the general trading rules were conservative because unlike in regulated systems, releases from storage cannot be used to offset diversions. These rules have been found to be appropriate where no other tools exist to manage unregulated trade. Where demands within a reach are low compared to flows and the movement of a licence upstream will not result in third party impacts, an exception could be made. Annual demand in the upper Murray main stem is less than one per cent, and minimum flows are reliably maintained by releases from hydro-electric schemes.</p> <p>Victoria's SDLs will be maintained (until the Basin Plan is introduced in Victoria) as a tool to assess the capacity to trade or transfer winter-fill licences between unregulated sub-catchments.</p> <p>The general trading rules, permitting downstream trade with a 20 per cent reduction in volume (unless to a winter-fill licence) and limiting upstream trade to winter-fill licences only, will be maintained. The Kiewa River (Trading Zone 191) will continue to be exempt from this rule and the upper Murray will be made exempt (including allowing upstream trade of direct pumping licences) by December 2009. Relaxing these trading rules in other part-regulated systems will be investigated by 2012, subject to assessment of third party impacts.</p> <p>In special circumstances, upstream trade to summer direct pumping licences may be allowed with a 20 per cent reduction, after an application by the licensing authority to the Secretary of the Department of Sustainability and Environment. This will be available from December 2009.</p>
	Improving trading information for unregulated systems	<p>In highly stressed systems, a declared WSPA freezes trade until a management plan confirms that trade is possible without adverse impacts. In the future, local management rules will be developed and may replace management plans in some areas.</p> <p>In unregulated river systems, trade is managed by general trading rules and rules specific to the trading zone within which the trade is to occur. However, these rules may be unintentionally limited, especially when coupled with clear restrictions policies (see page 64 and 69). It may therefore be possible to redefine unregulated trading zones to free up trade without causing unintended third party impacts.</p> <p>Rural water corporations will follow the 'Policies for Managing Take and Use Licences', released in September 2009 when assessing trade requests. Before trade opportunities are expanded in a given area, authorities should review restriction policies (winter and summer) to ensure they take into account the effects of trade and are in line with any other related management tools (for example, SDLs).</p> <p>The possibility of redefining trading zones in unregulated systems will be investigated by 2012 to determine whether trading can be liberalised.</p>
	Trading between unregulated and regulated systems	<p>Due to the differing characteristics of unregulated and regulated entitlements, facilitating trade between these products is difficult. A significant amount of additional work is required to see if trading opportunities can be improved.</p> <p>Options to promote trade between unregulated and regulated systems will continue to be developed.</p>
Trade in groundwater systems	Trade of groundwater	<p>Trade is the only means for new users to access groundwater in areas where the PCVs have been fully allocated (see Chapter 4). Permanent trade is not permitted in WSPAs until a groundwater management plan is approved. This is a barrier to new development in many areas as new users are unable to secure water on a permanent basis. The Commonwealth's new limits on groundwater extractions (see page 44) may also restrict the issuing of new licences in some areas.</p> <p>Options will be assessed by 2012 to encourage trade of groundwater allocation and licences, particularly the transfer of licences between groundwater management areas.</p> <p>These options will be considered in the context of the new Murray-Darling Basin Plan. Any changes will need to avoid unacceptable third party impacts, including on reliability and the environment.</p>



6

This chapter outlines actions that support a profitable and resilient irrigation sector by aligning system modernisation with on-farm, natural resource management and environmental programs.

Modern, efficient and sustainable irrigation

Guide to the chapter

Section 6.1 Modernising the water distribution system

- Current modernisation projects
- Maximising the benefits of modernisation
- Increasing confidence in water savings

Section 6.2 On-farm water use efficiency

- Current practices and initiatives

Section 6.3 Managing the impacts of irrigation

- Accounting and reporting of salinity impacts
- Capping salinity impacts
- Drainage programs

What is the issue with the existing arrangements?

Irrigation is a key factor in the region's ongoing prosperity. Climate change is likely to reduce the amount of water allocated to irrigators' water shares, resulting in a significant reduction in the area of land irrigated. In addition, the available water is currently being inefficiently delivered via an old and leaky distribution system, providing lower service levels than required by modern enterprises. With \$2.1 billion committed to renewing this infrastructure, the very nature of the distribution system is set to change. To maximise the benefits, it must be aligned with the other water programs currently being rolled out in this region. In this way, regional communities can be protected and grow prosperous, while maintaining river and wetland health in the face of reduced water availability.

What improvements does the Strategy make?

- 💧 Distribution system modernisation will be integrated with on-farm modernisation, water purchase and works programs – to support smart, efficient irrigation enterprises and maximise the community benefits of modernisation.
- 💧 Clear principles have been developed to guide the conversion of modernisation water savings to usable entitlements. These are critical to protect the reliability of existing entitlements and increase community confidence.
- 💧 Improvements are made to salinity management to ensure the region's irrigation continues to be as environmentally sustainable as possible.

6.1 Modernising the water distribution system

Modernisation reduces the amount of water required to operate the distribution system (that is, distribution system operating water). There are two aspects to modernisation: renewal and rationalisation (see Figure 6.1).

Renewal replaces old distribution infrastructure with modern equipment and technology that improves water efficiency. It can include activities such as channel automation, lining or piping of channels and metering upgrades. Modern meters and control systems provide improved service levels to the farm including uniform flow rates, a wide range of flow rates and short ordering times.

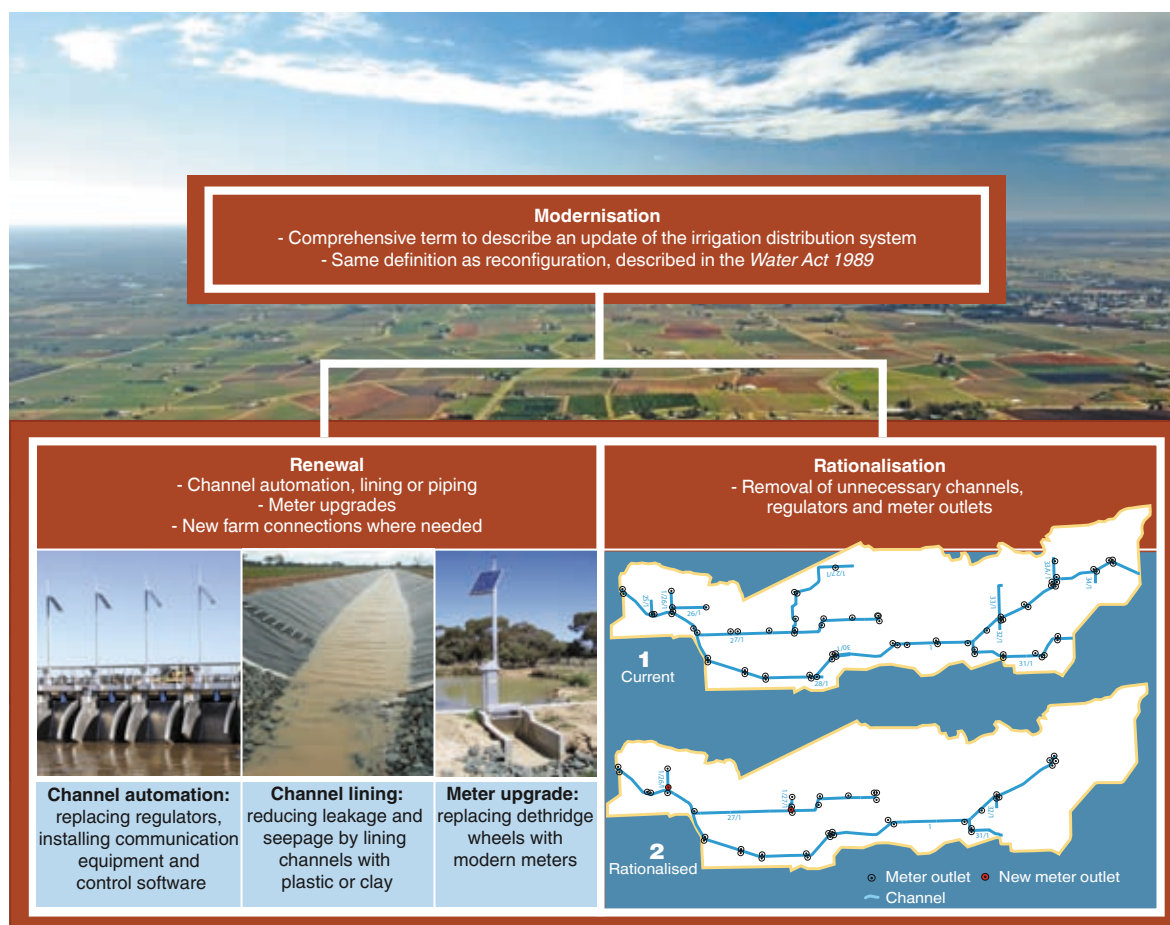
Rationalisation removes some infrastructure or channels or modifies them to provide a different level of service.

Through modernisation, system operating water can be transferred to more productive use, either for water users or the environment. Improved service levels create flexibility for farm businesses, giving more choice for irrigators about what to grow, when to grow it and how to apply water to crops. Ultimately, more resilient farm businesses generate wealth for regional communities.

Modernisation is now the generally accepted term for what used to be known as, and is described in the *Water Act 1989* as, reconfiguration. Community consultation is a legislative requirement of reconfiguration planning to ensure that community views are taken into account, providing greater certainty and options for customers. Where a channel or service will be closed, the preferred option is to negotiate this decision with customers.

NVIRP now has the powers and obligations conferred for reconfiguration planning under the *Water Act 1989*.

Figure 6.1 Defining distribution system modernisation terms



6.1.1 Current modernisation projects

Since 2000, the Victorian Government has been increasing investment in modernising the irrigation distribution system. Completed or partially completed irrigation modernisation projects demonstrate Victoria's ability to successfully deliver water savings and service improvements. The water savings from earlier projects have been used to meet the government's commitments to increase environmental flows through the Living Murray Initiative and the Snowy River Water Recovery Project (see page 130).

Northern Victoria Irrigation Renewal Project (NVIRP)

On average, about 30 per cent of water or 800-900 GL a year is required to operate the distribution systems in the Goulburn Murray Irrigation District. Even with the reduced inflows occurring since 1997, system operating water requirements are still recorded at about 30 per cent or 700 GL on average each year.

Through *Our Water Our Future – the Next Stage of the Government's Plan*, the Victorian Government recognised that future reductions in water availability will have a major impact on the state's food production region in northern Victoria. It therefore included a \$1 billion investment in Stage 1 of the Food Bowl Modernisation Project to secure the future of this area and improve the efficiency of the distribution system. A state-owned entity, NVIRP, has now been established to implement the Food Bowl Modernisation Project.

Funding for Stage 1 of NVIRP is shared by the Victorian Government (\$600 million), Melbourne Water (\$300 million) and Goulburn-Murray Water (\$100 million). The \$1 billion investment will deliver average annual water savings of up to 225 GL. These savings will be shared equally between irrigators in the Goulburn Murray Irrigation District, the environment and Melbourne water users. While some community members have expressed concern about some of the savings being transferred to Melbourne, Melbourne Water's investment was an important component of the project scope. The Victorian Government's investment recognises the benefits provided to communities in both the north and the south of the state.

The Commonwealth Government has agreed to fund up to \$1 billion for Stage 2 of the NVIRP, subject to due diligence. Stage 2 could secure up to 200 GL of additional annual water savings to be shared equally between irrigators and the environment. When both stages of the NVIRP are complete, the Goulburn Murray Irrigation District will become one of the largest automated and modernised irrigation distribution systems in the world and an international benchmark for irrigation delivery excellence.

In 2004, *Our Water Our Future* committed \$50 million to modernisation in the Northern Region and this program, which was managed by Goulburn-Murray Water, will be aligned with NVIRP.

In April 2009, it was announced that the future of the Campaspe Irrigation District will be reviewed as part of NVIRP. This will help entitlement-holders whose planning has been impaired by uncertainty following a number of zero allocation years. A reference group has been established including various Campaspe land-holders and representatives from the Campaspe Shire, Goulburn-Murray Water, NVIRP and the Modernisation Consultation Committee. The first stage is currently underway with the draft report on an irrigator survey being discussed with NVIRP, the reference group and the broader Campaspe community. The second phase will assess the most cost-effective and beneficial mix of options, including a Waranga-Campaspe pipeline and reticulated domestic and stock supplies.

Sunraysia Modernisation Project

At the 3 July 2008 meeting of COAG, the Commonwealth Government agreed in principle to provide \$103 million for the Sunraysia Modernisation Project, subject to due diligence. This project will modernise the irrigation supply infrastructure in the Merbein, Mildura and Red Cliffs Irrigation Districts to provide a year-round supply to irrigators. It will involve the comprehensive upgrading or replacement of the major components of the pumping and delivery systems. The quality of water and reliability of supply will be substantially enhanced.



Channel modernisation, Pyramid-Boort

Photographer: Ralph Ewart

6.1.2 Maximising the benefits of modernisation

Chapter 2 explores the risk of zero allocation years when there is insufficient water to operate the distribution system and Chapter 5 outlines actions to address this risk by increasing system reserves. System reserves and modernisation are linked because the latter reduces the amount of water required to operate the distribution system and improves the effectiveness of the reserve policy in securing system operation. The reserve policy in turn maximises the benefits of modernisation by ensuring that the upgraded distribution system will be fully utilised, even in severe drought years. This is particularly important to ensure the delivery of supplies for domestic and stock needs.

Under the most severe climate change scenario (Scenario D), the amount of water available for consumptive use could be reduced by 15 per cent in the Murray system and 30 per cent in the Goulburn system (see page 24). This will reduce the amount of water allocated to irrigators' water shares and could result in a significant reduction in the area of land irrigated. The resulting impact on irrigators, and the communities that depend on them, could be exacerbated by the movement of water from productive use to the environment, such as through the Commonwealth Government's \$3.1 billion program to purchase water entitlements for the environment (see page 45).

So how does modernisation help to address this challenge? Figure 6.1 defines modernisation as the upgrade and rationalisation of the distribution system. This infrastructure focus is a key element in supporting irrigation in the Northern Region. However, more is needed to modernise the entire irrigation sector. Appropriately integrating system modernisation with other water resource programs can significantly improve the productivity, environmental and community outcomes of irrigation. This will be critical if high-value and world-class irrigation is to continue in northern Victoria in the face of water scarcity.

In June 2009, a landmark agreement was reached to integrate Commonwealth water policy with Victorian water policy. Under this agreement, the Victorian Government has agreed to exempt some farmers from the four per cent trading limit (see page 108) where the sale is linked to a modernisation plan and will result

in a clear community benefit. This common-sense agreement targets purchases in less productive areas and protects the significant investment in modernising the distribution system. As part of the agreement, the Commonwealth confirmed a further \$300 million for on-farm works in the southern Murray-Darling Basin. The funds, which complement investment in distribution system modernisation, will improve on-farm efficiency and return a proportion of water savings to the environment. The agreement meets the joint aims of supporting a modern, vibrant and value-adding irrigation sector, while delivering more water for the environment. The joint approach enjoys broad community support; it is based on submissions from community modernisation committees, irrigation and environment peak industry groups, local councils and catchment management authorities.

"...Governments should be encouraged to pursue irrigation reconfiguration as a method of securing water outside the traditional water market to allow for the multiple benefits possible..."

– Draft Strategy submission DS068

This section outlines further opportunities to align such programs to protect and grow prosperous regional communities, while maintaining river and wetland health in the face of reduced water availability. This includes appropriate links with environmental and natural resource management programs. Integrating the programs as shown in Figure 6.2 will improve the flexibility and adaptability of the northern Victorian irrigation sector.



New channel lining, Central Goulburn

Photographer: Ralph Ewart

Figure 6.2 Modernising northern Victoria's irrigation sector

Infrastructure and planning investment

Infrastructure projects	On-farm improvements
<ul style="list-style-type: none"> - System renewal, including channel upgrades and automation, pipeline construction and metering upgrades - System rationalisation, including the closure of some channels - \$2b Northern Victoria Irrigation Renewal Project (Vic/C'wealth) - \$103m Sunraysia Modernisation Project (C'wealth) - \$425m Snowy Water Recovery Project (Vic/NSW/C'wealth) - \$1b Living Murray Initiative First Step (Basin governments) 	<ul style="list-style-type: none"> - Farm engagement and extension - Business planning and risk management through whole farm planning - On-farm efficiencies (including works and management practices) - \$26m over the next 3 years for Sustainable Irrigation Program (Vic) - \$300m On-farm Irrigation Efficiency Program (C'wealth)

Aligned with existing programs

Environmental water delivery	Natural resource management	Better regional planning	Commonwealth water purchases
<ul style="list-style-type: none"> - Use of structural works to deliver environmental water and reduce the need for water recovery (eg. purchase) - Design of delivery infrastructure to deliver environmental water (and consumptive water en route for environmental benefit) 	<ul style="list-style-type: none"> - Managing salinity and nutrient impacts through drainage network - \$12m over the next 3 years for salinity and drainage program (Vic) 	<ul style="list-style-type: none"> - For future management and zoning of rural land - Assist land amalgamation/ repackaging (eg. into viable irrigation enterprises, dryland purposes or ecosystem services) 	<ul style="list-style-type: none"> - Water entitlements purchased from willing sellers to address declining river health - \$3.1b Restoring the Balance in the Murray Darling Basin program (C'wealth)

Delivers multiple outcomes

Increased farm productivity, water savings for business and the environment, resilient communities, healthy rivers and wetlands.

There are many potential benefits of an integrated modernisation program.

Productivity will increase through:

- a modernised irrigation distribution system with reduced losses and better service levels
- the removal of costly stranded irrigation assets
- targeted water purchases to areas that are closing down to facilitate and protect investment in modern infrastructure
- investment in on-farm planning to increase production with less water and support/facilitate decisions to connect or reconfigure
- renewal of on-farm irrigation infrastructure reducing water losses and labour requirements
- improved water management options for farmers through carryover and trade which require changes to the system reserve policy (see Chapter 5).

Water savings will be generated by:

- increasing system efficiency, through reduced on-farm losses and distribution system operating requirements
- targeted water purchases in areas where land is being retired from irrigation.

Environmental outcomes will improve through:

- the allocation of water savings to environmental flows
- better environmental water management including investment in complementary measures, water recovery and structural works
- improved natural resource management to reduce salinity and nutrient impacts and avoid irrigation on severely affected floodplains.

Community benefits will be enhanced through:

- better water delivery service levels that support high-value, job-generating enterprises
- better quantification of water savings to ensure no impacts on entitlement-holders
- implementing both stages of NVIRP as a single project to ease potential customer confusion and reduce implementation costs
- more farm planning support for farmers who want to continue irrigating and those deciding to retire
- better support for community adjustment by directing Commonwealth purchases to areas that are closing down.

Process to achieve an integrated modernisation program

This section describes several steps to an integrated modernisation program and provides an indication of the benefits each provides. These steps will only be implemented if they do not impact on modernisation project timelines or water savings.

Step 1. *Direct some of the Commonwealth's \$3.1 billion water purchase*

Water savings		Productivity	✓
Community	✓	Environment	✓

Where water purchases are made as part of a modernisation plan, they will be exempt from the four per cent trading rule (see page 108) and the termination fee may be waived in part or full. Targeting purchases to less productive areas or where infrastructure is being rationalised will avoid the loss of water in modernised areas and improve regional productivity. Retaining the four per cent rule in all other circumstances will allow time for communities to adjust to the impacts of water leaving areas. Criteria to guide ongoing exemptions will be developed around:

- irrigation suitability, including soil type, environmental, floodplain and drainage considerations
- distance from the 'backbone' (major irrigation channels) of the distribution system
- the amount of water entitlement that has been sold out
- whether the exemption would facilitate structural/community adjustment.

Step 2. *Implementing NVIRP Stages 1 and 2 as a single project*

Water savings		Productivity	
Community	✓	Environment	

While the two stages of this project have different funding sources, the water savings targets, location, beneficiaries, timelines and nature of the works are similar. Integration of the two stages with a single point of contact would increase the efficiency of administrative processes and avoid competition for water savings. Both stages would use the same information, offer similar incentives and involve the same institutions and engagement processes. Responsibilities and reporting accountabilities will need to be negotiated with the Commonwealth Government.

Step 3. *Include a more comprehensive on-farm component*

Water savings	✓	Productivity	✓
Community	✓	Environment	

Whole farm planning, which guides farm infrastructure and management including how farms connect to the publicly-owned distribution system, will be integrated with NVIRP works. Whole farm plans will help to optimise the benefits of improved service levels offered by modernisation. The Commonwealth has recently committed \$300 million to on-farm works to improve efficiency in the southern Murray-Darling Basin, with a portion of savings to go to the environment. The works program will be aligned with NVIRP and a whole farm plan will be required to qualify for a grant. The scope of whole farm planning also needs to be expanded with a greater focus on business/financial planning and risk management to help those wishing to continue irrigation, retire or otherwise leave the industry. For example, it could facilitate disconnections from the system and subsequent conversion to dryland farming or ecosystem services. Early inclusion of the on-farm component in modernisation projects will improve confidence in rationalisation decisions.

Step 4. *Allow for a greater range of options in rationalisation*

Water savings	✓	Productivity	✓
Community		Environment	✓

To improve the overall productivity of irrigation in the region and reduce its environmental footprint, land suitability and salinity considerations will be incorporated to rationalisation decisions. Options to prevent future irrigation of this land, including the surrender of associated water-use licences, will be investigated. Where channels are identified for closure and entitlement-holders no longer wish to irrigate, they can choose to sell their water shares or alternatively, can enter a commercial agreement to surrender their water shares, which will be counted towards NVIRP's water savings.

Step 5. Facilitating changed land management practices

Water savings		Productivity	✓
Community		Environment	✓

Land use zoning and planning provisions should be streamlined to facilitate changed land management practices. This will help with the implementation of modernisation programs and provide broader regional benefits. For example, where the Commonwealth Government or other organisations purchase property/ water packages as part of modernisation, they may wish to repackage and resell the properties as larger, more viable, dryland enterprises or for ecosystem services including revegetation for habitat or carbon offset purposes. Alternatively, they could provide Traditional Owners with title to land. Some or all of the water entitlements could go to the environment.

Step 6. Identify opportunities for works to deliver environmental water

Water savings		Productivity	
Community		Environment	✓

NVIRP will consult catchment management authorities on environmental requirements for water delivery when designing upgrades to distribution system infrastructure, although any material cost increases will be funded by the catchment management authority. In addition, Victoria will put forward a prospectus of opportunities for structural works and encourage the Commonwealth to redirect a portion of their Water for the Future funding to the construction of these works to efficiently deliver environmental outcomes (see page 45). This will be just as important as water recovery in the protection of environmental assets in the face of climate change.

Action 6.1: Integrating programs to modernise the irrigation sector

Who: NVIRP; Department of Sustainability and Environment; Goulburn-Murray Water

Timeframe: Various (see dot points below)

To increase productivity and water savings and improve environmental and community outcomes, programs to modernise the irrigation sector in northern Victoria will be integrated by:

- directing the Commonwealth's water purchases to less productive areas by exempting purchases from the four per cent trading limit when they are linked to modernisation plans (2008/09-2012/13)
- co-ordinating the rollout of Stages 1 and 2 of NVIRP (2009-2012)
- linking NVIRP to comprehensive on-farm programs, including integration with whole farm planning and the Commonwealth's \$300 million on-farm program (2009/10-2012/13)
- allowing for a greater range of options in rationalisation (2009-2012)
- working with local government to facilitate changed land management practices (2009-2012)
- identifying opportunities for structural works to enable delivery of environmental water and consumptive water en route for environmental benefit (2010).

Program integration will be built into the design and implementation of NVIRP but will only occur where it does not impact on project timelines or water savings.

Integration opportunities will also be investigated in the implementation of the Sunraysia Modernisation Project.

6.1.3 Increasing confidence in water savings

While not a major focus of the Draft Strategy consultation, some community members raised concerns about how water savings from modernisation projects would be quantified to protect existing entitlements.

The finalisation of the *Water Savings Protocol for the Quantification of Water Savings from Irrigation Modernisation Projects* will increase confidence in water savings projects. The Protocol was developed to provide a consistent and sound technical basis to calculate water savings from modernisation works. It is made up of a series of technical documents that will guide water corporations and project proponents in the estimation, application for, and allocation of water savings from irrigation modernisation projects.

The Protocol not only provides detailed calculations for water savings based on engineering principles, but also describes an independent audit procedure that is to be undertaken for each project. The annual independent audit of the water savings will demonstrate that water savings from the project are real. Making the Protocol and audit results publicly available improves the rigour and transparency of water savings quantification. Ultimately, these procedures will clearly demonstrate that when new entitlements are created from water savings there is no adverse impact on existing entitlement-holders or the environment.

The Protocol is available from www.ourwater.vic.gov.au/programs/irrigation-renewal. The following sections outline the key principles in the Protocol.

Policy 6.1: Principles to guide the conversion of water savings to entitlements

- a) Savings of system operating water in the irrigation distribution system may by agreement be converted to entitlements (in accordance with the *Water Act 1989*) and will go to the investors, or beneficiaries of the investors in the works and measures to achieve the savings.
- b) Water savings are the total (gross) volumes saved less the volume of water required to ensure no net impacts from the project on high environmental values.
- c) Evaporation and seepage losses associated with water storage and operation of river systems are part of storage losses or river operating water. Savings made in storage losses or river operating water will go to the investors, or beneficiaries of the investors in the works and measures to achieve the savings.
- d) Water savings converted to entitlements must be ongoing and quantifiable.
- e) The volume and availability of water savings will reflect the nature of water which was saved.
- f) Water savings must be sustainable over the long term (that is, the improved assets and operating practices on which the savings depend are to be maintained).
- g) The base year against which savings are assessed should be consistent with the basis of establishing the loss allowance in bulk entitlements.



Sheep, Goulburn catchment

Photographer: Alison Pouliot

Policy 6.2: Roles and obligations in water savings projects

The project proponent will:

- identify the water saving opportunities
- devise and develop the scope of projects in conjunction with the system operator
- seek all necessary approvals to works and endorsement of their associated water savings
- identify potential environmental impacts and mitigation measures and consult with the appropriate environmental managers at a State and Commonwealth level
- quantify the volume of water savings to be generated by each intervention in accordance with the methodology outlined in the *Technical Manual for the Quantification of Water Savings*
- prior to implementing the annual works program, and at reasonable intervals throughout the season if requested by the system operator, calculate the estimated interim water savings for the current/future irrigation season for the purpose of setting this water aside for future allocation
- communicate to the system operator the planned annual works program and changes as they occur
- implement works in accordance with the works program
- communicate any significant departures from the planned works program, as it is implemented, to the system operator
- notify the system operator and the Executive Director of Water Entitlements and Strategies, within the Department of Sustainability and Environment ('the Department'), of the volumes of water that are expected to be set aside ('interim savings') and transferred ('long-term savings') as a result of each intervention being implemented
- calculate the actual water savings arising from the works in accordance with the *Technical Manual for the Quantification of Water Savings* to determine both the interim and the long-term water savings
- report, as required, the projected interim and final water savings including any details of changes from the overall targeted volumes of water savings for the project or water savings intervention
- arrange for an independent audit and report of the water savings utilising the independent auditor(s) awarded to the auditing of water savings by the independent panel in accordance with the audit process
- advise the system operator and Executive Director of Water Entitlements and Strategies, within the Department, on the outcomes of the water savings audit.

The water corporation will:

- ensure water delivery services can continue to be provided to water entitlement holders on the system
- on the advice of the proponent, consult with system water users impacted by the agreed project works
- provide water system asset information required to enable the project proponent to complete interim and long-term water savings projections
- apply to the Minister for Water to amend/transfer part of the savings as water entitlement
- operate and maintain the water delivery system in accordance with the agreed project objectives and ensure accountable water savings are sustainable and maintained in the long term.

The system operator will:

- provide to the proponent, projections of annual water deliveries and allocations to enable the progressive calculation of interim water savings as the project is implemented
- manage and collect water delivery system flow (inflow and outflow) measurement data and make that data available to the project proponent
- ensure provision of water related data to the project proponent and the Department is guaranteed through a quality assurance process; where the data has been modified or filtered, provide both the raw and modified data including documentation of reasons for modification
- at the start of each irrigation season, or progressively as agreed, set aside the amounts of water projected to be saved in the year ahead through the modernisation works
- confirm the estimates of actual water savings provided by the project proponent and where necessary recommend an amendment to those savings for consideration by the project proponent.

The Minister for Water and associated departments will:

- with the support of the Department, update the Protocol to ensure continual improvement and the use of the best technical basis available at the time
- with the support of the Department and at the request of the bulk entitlement-holder, amend and transfer bulk entitlements to represent the long-term water savings realised through the modernisation program.

The Department for Sustainability and Environment will:

- support the Minister for Water in administering the *Technical Manual for the Quantification of Water Savings* and the associated audit processes
- support the Minister for Water in amending and transferring bulk entitlements
- recommend to the Minister for Water updates to the Protocols, particularly the *Technical Manual for the Quantification of Water Savings*, to ensure continual improvement and the use of the best technical basis available at the time
- convene a meeting with the system operator, the project proponent and the Department a minimum of every six months to review the application of the *Technical Manual for the Quantification of Water Savings* in northern Victoria
- establish a panel of independent auditors which may be used to audit water savings estimates and related baseline data (both interim savings on annual basis and long-term savings at the end of the water savings project)
- establish an agreed methodology for calculating the annual long-term cap equivalent conversion factor to be used in long-term water savings estimates
- provide the project proponent (and system operator if requested) with the long-term cap equivalent conversion factors for particular years.

The Minister for Planning and associated departments will:

- provide advice on processes to assess environmental impacts of the works and measures proposed by the project proponent
- oversee the planning requirements for the works proposed by the project proponent.

The Minister for Environment and associated departments will:

- work with environmental managers and decision makers to investigate any potential environmental impacts of works and seek multiple benefit outcomes
- provide advice when requested to the Minister for Planning and / or Minister for Water on potential environmental impacts of the project and suitable mitigation measures.

Catchment management authorities (environmental managers) will:

- improve river and wetland health through the use of the EWR and delivery of complementary restoration works
- work with the water savings project proponent to identify potential environmental impacts of the actions and potential mitigation measures proposed by the project proponent
- work with the project proponent and system operator to seek multiple benefit projects and multiple project benefits
- in instances where Parks Victoria is the owner or custodian of the land, the catchment responsibilities for the maintenance of catchment health will be delivered through Parks Victoria.

The Murray-Darling Basin Authority will:

- ensure appropriate water diversion accounting against the Murray-Darling Basin Cap on allowable annual diversions, with details of the future role of the Authority in relation to water savings to be resolved as part of the Basin Plan.

6.2 On-farm water use efficiency

In times of water scarcity, improved on-farm water efficiency is an economically viable alternative to reducing crop or herd size (that is, reducing production). Diversifying into less water-demanding and more profitable crops or improving the efficiency of current crops can allow farmers to increase production and productivity even with reduced allocations.

Farm water efficiency can be improved by applying water at a time and volume that meets the needs of crops. Current farm water efficiency ranges from less than 60 to more than 90 per cent⁵⁰. Higher efficiency means less water is lost to deep drainage, leakage, evaporation or surface runoff, which in turn can reduce salinity, water-logging and nutrient impacts. Factors that influence farm water efficiency include the type of irrigation system, drainage and reuse systems, management practices such as scheduling and management of surface irrigation flows, crop and soil types and the quality of applied water.

6.2.1 Current practices and initiatives

Victoria's Sustainable Irrigation Program has been operating since the late 1980s with annual funding of about \$15 million. In partnership with irrigators, the program has delivered significant improvements in on-farm water efficiency and reduced nutrient and salinity impacts on the environment.

In 2003/04, \$23 million was committed for eight years to encourage whole farm planning, reuse systems, irrigation system upgrades and groundwater pumping. To date this investment has resulted in:

- an additional 38,000 ha of land being surveyed or subject to a whole farm plan, with significant improvements in water efficiency and diversion of salts from the Murray-Darling Basin
- almost 17,000 ha of land being protected by reuse systems and 25,700 kg of phosphorous prevented from entering waterways
- significant volumes of water saved using reuse systems (13.8 GL), groundwater pumps (1.9 GL) and improved irrigation (6.1 GL) – a total of at least 21.8 GL
- increased productivity from the irrigation regions, and improved ability to cope with drought or low water allocations.

On-farm programs are being adapted to significantly improve the benefits from, and facilitate the delivery of, modernisation.

Linking farm and catchment programs to modernisation

To improve the benefits from system modernisation, and reduce adverse impacts on the environment, modernisation must be aligned with farm and catchment management programs. The Victorian Government has committed to fund the \$12 million Linking Farm and Catchment Programs to Irrigation Modernisation Initiative. The initiative is delivered through the Sustainable Irrigation Program.

This will support the integrated approach to modernisation programs described on page 118 by linking current farm and catchment-focused engagement, extension and works programs with distribution system modernisation programs. This includes the Commonwealth Government's \$300 million program for on-farm works in the southern Murray-Darling Basin, which will be aligned with NVIRP and implemented by catchment management authorities.

The initiative complements the Victorian Government's *Future Farming* strategy that supports farm business decision-making (see page 168 and www.dpi.vic.gov.au).

To assess the magnitude of farm water losses and the potential for improved on-farm water use efficiency the Victorian Government undertook a benchmarking study⁵¹. This establishes data measures to determine the water efficiency of metered irrigated agriculture at industry and regional levels. It also provides the ability to set state-wide targets for farm water efficiency. Together these investment programs will improve on-farm efficiency while improving the robustness of farm businesses in the face of change.

6.3 Managing the impacts of irrigation

Chapter 2 highlighted that salinity continues to be one of the most prevalent water quality problems in the Northern Region. Substantial reserves of salt are stored in the soils of northern Victoria and as groundwater levels rise due to clearing of native vegetation and irrigation, these salts are brought closer to the surface where they affect crop productivity and can be washed into streams. Continuing to improve salinity management is central to ensuring environmentally sustainable irrigation.

The management of dryland and irrigation salinity is governed by the 15-year Basin Salinity Management Strategy (BSMS), an agreement between the Basin states to prevent further degradation from salinity⁶². Under the provisions of the BSMS, if an action results in additional salt entering the River Murray, it incurs a salinity debit. If it results in less salt entering the River Murray, it earns a salinity credit. Total salinity credits must equal or exceed total debits for Victoria to meet its obligations under the BSMS. Salinity is measured by electrical conductivity or EC units. If an action has a net impact greater than 0.1EC it is termed an 'accountable action' and is tracked through the Murray-Darling Basin Authority's salinity registers.

The BSMS was released in 2001 and underwent a mid-term review in 2008. The review proposed a series of recommendations to address future challenges for salinity management arising from severe droughts, changing climate and institutional developments. Victoria's Sustainable Irrigation Program is working with other jurisdictions to implement these recommendations.

By approving the Basin Plan, which will include a water quality and salinity management plan, the Commonwealth Government now has a greater role in salinity management. The plan will include water quality and salinity objectives and targets for Basin water resources. Before the implementation of the Basin Plan, Victoria will continue to maintain compliance with BSMS obligations. Contributing to the Basin Plan's water quality and salinity management plan will be a priority for Victoria's Sustainable Irrigation Program.

The *Victorian Manual of Salt Disposal in the Murray-Darling Basin*⁶³ documents how salinity is managed within Victoria to meet BSMS obligations. The manual will be revised to account for management changes including the unbundling of water entitlements in Victoria, BSMS mid-term review and Basin Plan and changed institutional arrangements.

Action 6.2: Updating Victoria's approach to salinity management

Who: Department of Sustainability and Environment; catchment management authorities; rural water corporations

Timeframe: 2010

The *Victorian Manual of Salt Disposal in the Murray-Darling Basin* will be updated to account for a range of recent changes including the unbundling of water entitlements, recommendations from the Basin Salinity Management Strategy mid-term review and changed institutional arrangements. Further amendments may be required after the release of the Basin Plan.

6.3.1 Accounting and reporting of salinity impacts

The unbundling of water entitlements means permanent water trade into or out of an area is no longer a reasonable measure of water use within an area (and therefore of salinity impact). The impact of irrigation on river salinity is now controlled through the annual use limit (AUL) on the water-use licence. The AUL sets the maximum amount of water that can be used for irrigation on the property, and is a key way of controlling groundwater infiltration and high water tables. This approach is particularly useful in the Sunraysia region where salinity impact zones have been established. The volume of water use in these zones can be capped, which in turn limits the salinity impacts of irrigation within a given area.

The total volume of AULs in a salinity impact zone can be easily measured and reported through the Victorian Water Register. Salinity accountability reporting and the administration of charges and levies by water corporations will be based on the AULs. The change in AULs over each 12-month reporting period will be the method of accounting for salinity impacts in salinity impact zones. Work is underway to prepare salinity accounting procedures using AULs, which will be completed in time for implementation in the 2009/10 irrigation season.

Changes to land and water use as a consequence of environmental water recovery and modernisation programs will alter salinity impacts. These changes are generally associated with water recovery (for example, decreased outfalls and flows in drains), transfers (for example, savings going to Melbourne) and environmental use (for example, additional environmental flows). The existing accountability framework under the BSMS, including interstate accountability, is adequate to address the implications of these changes, but detailed procedures clarifying how salinity impacts of the projects will be managed need to be developed.

Action 6.3: Salinity accounting and reporting

Who: Department of Sustainability and Environment; catchment management authorities; rural water corporations

Timeframe: 2010

The salinity impacts of water use in irrigation areas will be managed through water-use licences and associated annual use limits. A process will be established to monitor the annual change in annual use limits through the water register. The change in annual use limits will be used to calculate and report on the new irrigation development accountable action within existing salinity impact zones in the Sunraysia region.

The following will guide the development of procedures to manage the salinity impact of modernisation projects:

- Establish a systematic process to manage the salinity impacts of environmental water use through use conditions relating to an entitlement (*Water Act 1989*, Section 48J).
- Salinity impacts of modernisation projects will be evaluated in terms of total credits and debits (not net impact) and separated into components of recovery, transfer and use.
- A 'user pays' principle will be applied to any modernisation project undertaken in Victoria.
- The responsibility for offsetting any net costs of projects will be shared according to a process agreed as part of the project investment strategy.
- As far as practical, salinity impacts of water infrastructure projects will be evaluated and accounted for at a regional level, and built into existing salinity register entries.

6.3.2 Capping salinity impacts

The use of AULs as the salinity accounting mechanism requires the existing caps on water trade into the highest impact zones in Sunraysia to be converted to an equivalent AUL volume. This change will have no affect on water users in the zones.

Further expansion of irrigated area in the Sunraysia region will increase the amount of salt entering the River Murray. To maintain Victoria's compliance with the BSMS additional salt credits will be needed to cover the impact. To keep salinity impacts and the need to generate additional credits to a minimum, AULs in Low Impact Zones 3 and 4 will be capped. Future development will subsequently be directed to Low Impact Zones 1 and 2 where the amount of salt mobilised from irrigated land is much less. The AUL cap in Low Impact Zones 3 and 4 will be

a 'rolling' cap, which can be adjusted upwards to allow for further irrigation development when Victoria obtains additional salinity credits through its ongoing programs. This 'rolling' cap approach is different to the 'absolute' cap in the High Impact Zone. Maps of the salinity impact zones are available at www.waterregister.vic.gov.au.

Although salinity impact zoning is only applied in Sunraysia, there are other areas in the Northern Region where irrigation has significant salinity impacts. The Department of Sustainability and Environment, in partnership with catchment management authorities and water corporations, will investigate the possible role of salinity impact zones in these locations. One benefit of extending the zoning approach would be to allow for salinity impacts to be recognised in a systematic manner in areas where water has been traded out or may be traded out in the future.

Action 6.4: Capping salinity impacts

Who: Department of Sustainability and Environment; catchment management authorities; rural water corporations

Timeframe: 2010

To maintain a robust, practical and affordable process to manage salinity on farms across northern Victoria, Victoria will:

- establish a rolling cap on total annual use limit volume in Low Impact Zones 3 and 4 in the Sunraysia region
- investigate the need to expand the salinity impact zones to areas upstream of Nyah
- continue to investigate further refinements in the management of salinity impact zones, such as the ability to trade annual use limits.



Salt tree, Karadoc Swamp

Photographer: Bob Merlin, Mallee Catchment Management Authority

6.3.3 Drainage programs

The Victorian Government has long undertaken irrigation drainage schemes, which involve surface or sub-surface water management to mitigate irrigation-induced salinity and water logging. In the Goulburn Murray Irrigation District, there is a memorandum of understanding between the Department of Sustainability and Environment, Goulburn-Murray Water, the Environmental Protection Authority Victoria and the North Central and Goulburn Broken Catchment Management Authorities to coordinate the management of irrigation drainage water to improve water quality.

Under the BSMS, if drainage works have a significant impact on land and water salinity, they must be accounted for. However several factors are reducing irrigation drainage volumes, including:

- reduced rainfall due to climate change and drought
- improved farm irrigation practices and water use efficiency
- irrigation supply system modernisation
- increased use of shallow groundwater as an alternative water source.

The Victorian Government is currently reviewing Victoria's irrigation drainage program to understand how these changes will alter the requirements for drainage investment.

Policy 6.3: Continuing support for the Sustainable Irrigation Program

The Victorian Government is committed to maintaining its current investment in the Sustainable Irrigation Program in recognition of the role the program will play in:

- linking farm and catchment focused engagement, extension and works programs (including the Commonwealth Government's \$300 million program for on-farm works) to distribution system modernisation (see page 117)
- implementing recommendations from the Basin Salinity Management Strategy mid-term review (see page 123)
- leading Victoria's input to the water quality and salinity elements of the Basin Plan (see page 123)
- implementing recommendations from the review of Victoria's irrigation drainage program.

7

This chapter outlines actions to better target environmental water recovery, use environmental water more efficiently and ensure an adaptive, integrated approach to protect our most important environmental assets.



High-value rivers, wetlands and floodplains

Guide to the chapter

Section 7.1 Environmental water

- Targeted recovery of environmental water
- Efficient use of environmental water

Section 7.2 Complementary restoration measures

- Managing water quality
- Protecting riparian land
- Safeguarding in-stream habitat

Section 7.3 Adaptive and integrated management

- The seasonally adaptive approach
- Ongoing monitoring and evaluation
- Adaptive management over the next 10 years
- Process for reviewing environmental objectives

What is the issue with the existing arrangements?

Climate change will reduce the environment's share of water far more than that of water users. Environmental flows could be halved in the Murray and reduced by up to 70 per cent in the Goulburn system. The uncertainty and potential severity of climate change requires much more adaptive and targeted management. Just as it may not be possible to maintain current irrigation levels in the region, ultimately, it may not be possible to meet all of our current environmental objectives in a climate change world.

What improvements does the Strategy make?

- 💧 Builds on existing commitments that will increase environmental flows by an average of 400 GL a year.
- 💧 Identifies a range of tools, including carryover, reuse, structural works and complementary restoration measures, to ensure more efficient use of environmental water – to get as much benefit as we can from every drop.
- 💧 Applies lessons from the recent drought to improve future decisions about river and wetland health. In particular, decisions about where to use available environmental water in any year will be guided by the 'seasonally adaptive approach'.
- 💧 Uses an innovative 6-category approach to identify priorities for the next stage of water recovery. These 'targets' will be a valuable input to increase the benefits from the Commonwealth Government's \$3.1 billion water purchase program.
- 💧 As part of an adaptive management approach, identifies a reasoned and transparent process for changing environmental objectives if necessary.
- 💧 No matter what happens, we must be able to protect our most valued environmental assets for current and future generations to enjoy.

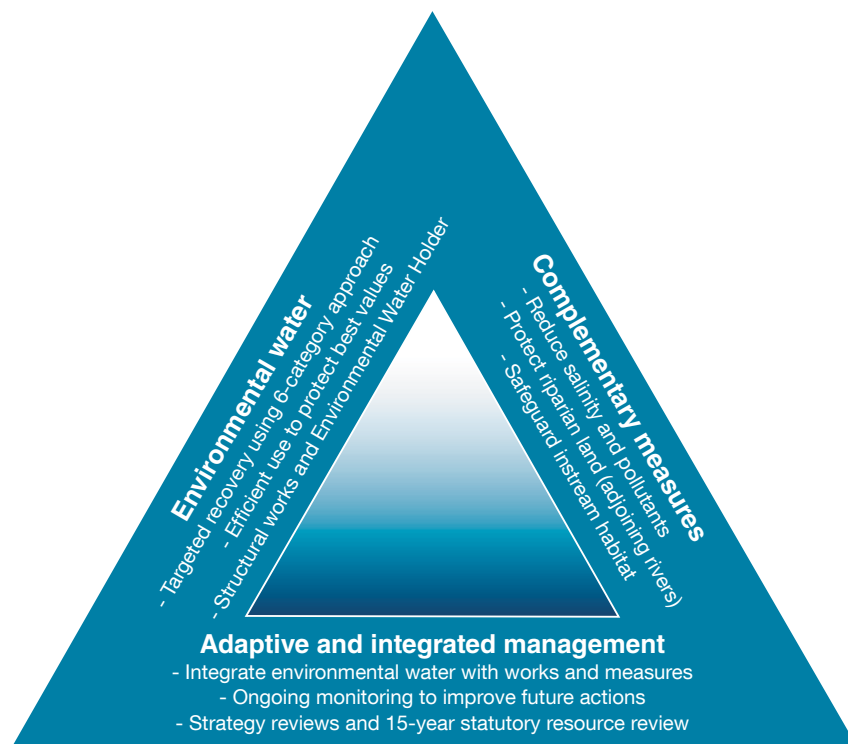
Communities in the Northern Region rely on healthy rivers and wetlands to provide reliable, high-quality water for households, farms and industry, to maintain social, cultural and heritage assets and for recreational and tourism opportunities. The community derives considerable economic benefits from our rivers – and pays a considerable cost when their condition declines.

Drought and climate change mean that a stronger approach is required for managing rivers, wetlands and floodplains (see Figure 7.1). This will focus on three ways to improve environmental management:

1. Targeted recovery and efficient use of environmental water.
2. Complementary river restoration works and measures.
3. Integrated and adaptive management of environmental water and works.

This chapter outlines each of these aspects. The first section discusses regulated river systems where environmental flows can be held in storage, with the ability to control the timing and rate of release. The second and third sections cover both regulated and unregulated river systems. Unregulated river systems, where flows cannot be actively managed in this way, are discussed in more detail in Chapter 4.

Figure 7.1 A stronger approach to environmental management



7.1 Environmental water

In Victoria, environmental water is referred to as the 'environmental water reserve' or EWR (see page 10). Existing environmental entitlements provide on average 232 GL a year (see Appendix 4). This is the portion of the EWR that can be called out of storage when needed and actively managed to maximise benefits. It accounts for about six per cent of the average Murray environmental flows of 4,089 GL a year (see Appendix 2). The remainder is provided by unregulated flows and spills from storages. Spills from storages are particularly reduced under climate change because emptier storages can capture a greater proportion of inflows. As a result, climate change will impact the environment's share of water far more than that of water users. Environmental flows could be halved in the Murray and reduced by up to 70 per cent in the Goulburn system (see page 24).

"We are concerned that the environment's share of water entitlements is disproportionately affected in dry times... [and] that this 'balance' between consumptive use and the environment does not meet community expectations."

– Draft Strategy submission DS129

7.1.1 Targeted recovery of environmental water

In many systems, the amount of water in the EWR is insufficient to protect the environmental assets that communities value. These assets are identified by catchment management authorities through consultation on their regional river health strategies. The Victorian Government has committed significant investment to protect them by recovering an expected 400 GL of water in the region (see Table 7.1). Three-quarters of this will be provided by 2013; the timing of the remaining 100 GL is still to be agreed with the Commonwealth Government.

Table 7.1 Existing initiatives to recover water for the environment in the Northern Region

Project name	Volume (GL/year)*, reliability [~] and holder			Project description and comments
Living Murray Initiative	67	HR/LR	VEWH [^]	Focuses on environmental benefits in six significant ecological assets (icon sites). Victoria has committed \$115m over five years to recover 214 GL of water for the River Murray by June 2009. Total Basin commitment is \$500m for 500 GL by 2009.
	120	LR		
	27	LR – unreg [§]		
Snowy Water Recovery Project	35	LR	CEWH [#]	About 1,000 GL/year of water is diverted from the Snowy River to the River Murray. Through the Snowy River Water Recovery Project, the Victorian, New South Wales and Commonwealth Governments committed \$375m to return 21 per cent of the original flows (212 GL) to the Snowy River by 2013. 70 GL of this will go to environmental flows in the River Murray (shared commitment from Victoria and New South Wales).
Northern Victoria Irrigation Renewal Project (Stage 1)	75	HR/LR	VEWH [^]	Water savings are generated by modernising the distribution system (see page 119 for full details). Total commitment is \$1b for 225 GL by 2013 (with cost share between Victorian Government, Goulburn-Murray Water and Melbourne Water). A third of the savings will be allocated to the environment.
Northern Victoria Irrigation Renewal Project (Stage 2)	100	HR/LR	CEWH [#]	Water savings are generated by modernising the distribution system (see page 113 for full details). Total commitment is \$1b for 200 GL (with commitment by Commonwealth Government). Half the savings will be allocated to the environment.
Total recovery (GL/year)	424			

* Estimate of the average amount of water provided each year assuming long-term average water availability. Outlines the volume of water recovered in Victoria only (not interstate projects).

[~] High-reliability or low-reliability.

[§] Low-reliability entitlement from unregulated flows.

[#] Commonwealth Environmental Water Holder.

[^] Victorian Environmental Water Holder (once established – see page 137).

The Victorian Government's approach to environmental water recovery has been to generate water savings that can be converted to environmental entitlements because savings have little (if any) impact on entitlement-holders and regional communities. However, water savings are finite and other approaches are now required.

One alternative to water savings projects is the purchase of water entitlements. In 2008, the Commonwealth Government committed \$3.1 billion to purchase water entitlements for the environment. Chapter 3 outlines recommendations to limit the socio-economic impacts of this water purchase by targeting and integrating water purchase with irrigation modernisation. The remainder of this chapter addresses ways to maximise the environmental benefits from such purchases.

Once the projects in Table 7.1 are complete and assuming the Commonwealth Government achieves its aim of purchasing 460 GL over the next five years (see page 45), the volume provided by environmental entitlements could be increased to about 960 GL*. This would increase the proportion of the EWR held as environmental entitlements from six to 20 per cent, better equipping environmental managers to maximise benefits by actively managing environmental flows.

The 6-category approach to guide water recovery and works

A more targeted approach is required to guide where Victoria wants water recovery in regulated systems to occur and identify what the benefits would be; the 6-category approach had been developed to achieve this. Figure 7.2 outlines the potential environmental outcomes and the necessary flow components to achieve them. Environmental health progressively improves from Category 1 through to Category 6 as more water is provided for environmental flows.

The healthiest systems (Categories 5 and 6) retain the majority of natural connections between the river and its floodplain wetlands. Category 6 means the full scientific flow recommendations are met⁵⁰. This does not mean it is in pristine condition, but the important values and functions identified by catchment management authorities are maintained and self-sustaining. At Category 5, the floodplain is provided with some overbank flows, likely supplemented with flows delivered by structural works such as pumps and/or regulators. An example of these is the Living Murray works and measures program for the icon sites along the River Murray.

For the in-stream river system, Categories 3 and 4 fit the concept of a 'working river' where environmental values are traded off to meet community needs. Categories 1 and 2 represent a 'survival' regime where only enough water is provided to get through a dry period. This type of flow is insufficient in the long term and would lead to a rapid and continued deterioration of river health and likely loss of many species at a local and regional scale.

For wetland systems that are disconnected from the river, Categories 3 and 4 provide sufficient water through structural works to maintain all or some sites (defined as a high-value wetland within a system). Category 2 aims to support high quality habitats at a limited number of priority sites, while Category 1 focuses on maintaining the priority sites as drought refugia. Again, this type of flow is insufficient in the long term. If water recovery has secured these sites, the focus moves to the remaining wetlands.



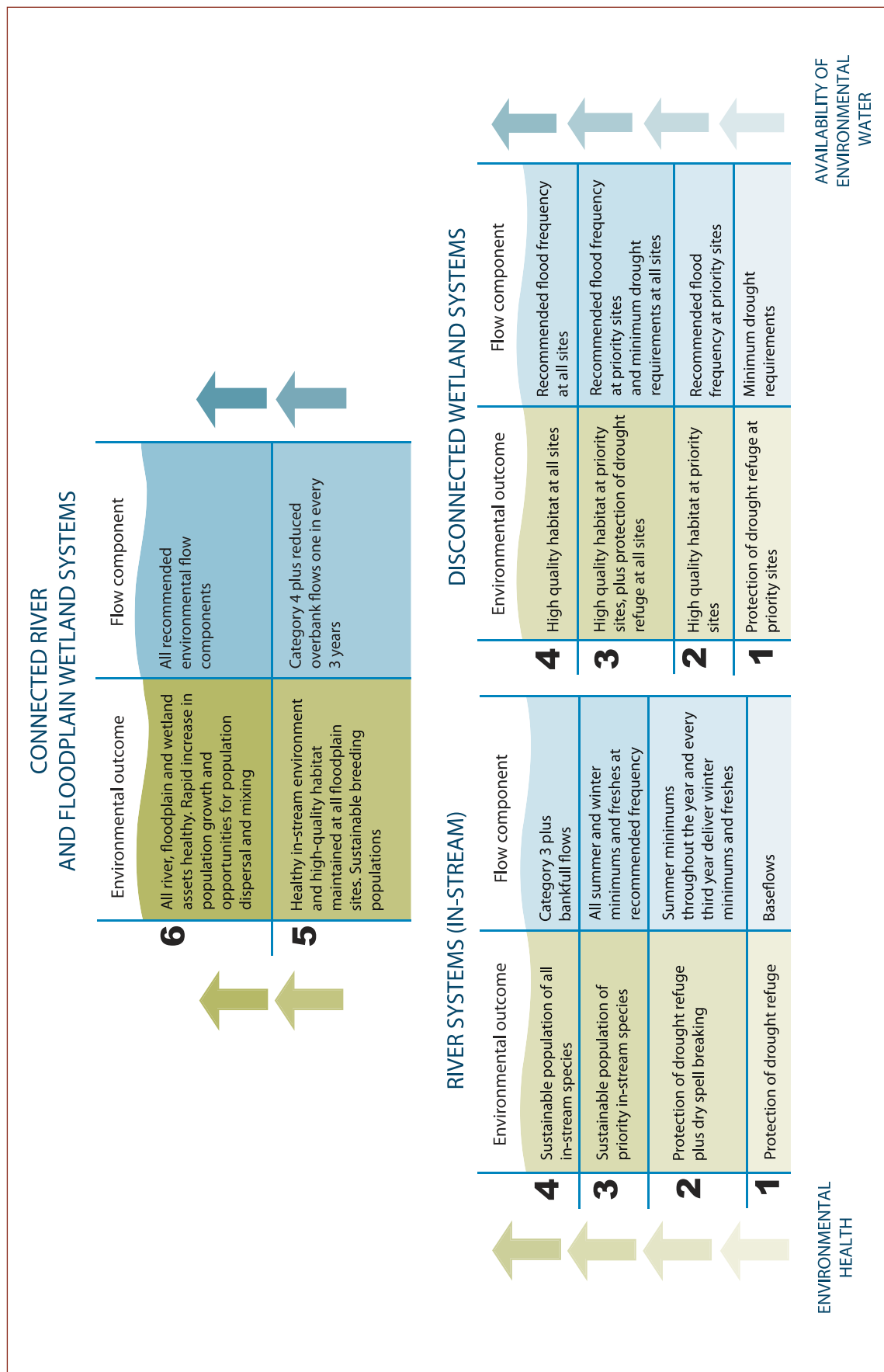
Ducks, Butlers Creek

Photographer: Bob Merlin, Mallee Catchment Management Authority

Footnote:

* The total of 960 GL includes 232 GL from existing entitlements (see Appendix 4), 94 GL from Living Murray projects still to be completed, 75 GL from NVIRP Stage 1, 100 GL from NVIRP Stage 2 and 460 GL from assumed Commonwealth purchases.

Figure 7.2 The 6 category approach to guide investment in water recovery and works



Setting water recovery targets for river and wetland systems

A water recovery target of a particular volume will provide different outcomes under different climate scenarios. If water availability decreases with climate change, so does the reliability of recovered entitlements, and environmental benefits are reduced. The objective of water recovery for rivers was proposed and agreed through the Draft Strategy.

In river systems where the current EWR does not meet scientific recommendations, water recovery targets aim to:

- significantly improve the health of priority reaches to at least a Category 4 under the current climate (base case)
- at least maintain drought refugia at a Category 2 for the highest value reaches under a continuation of recent low inflows (Scenario D).

The public forums and submissions elicited mixed views on the category approach to guide water recovery targets. Many people agreed that there needed to be an appropriate balance of environmental and socio-economic considerations. Some believed water recovery targets would not go far enough in protecting the region's rivers and wetlands. Others were concerned that this level of water recovery would significantly impact on the regional economy. The agreed objective provides a balance because:

- there will be opportunities over the next 10 years to amend targets if required (see page 150)
- the Victorian and Commonwealth Governments are working together to minimise the impacts of water recovery on the region's economy (see page 167).

The 6-category approach has been applied to the major river systems in the Northern Region, assuming that the water recovery commitments in Table 7.1 are

complete. Using this approach, it has been calculated that an extra 305 GL per year is required to achieve at least a Category 4 under the base case and at least a Category 2 under the most severe climate scenario (see Table 7.2 and Figure 7.3). To place this in context, about 4,095 GL a year is able to be taken for consumptive use, with 4,089 GL provided for environmental flows (see Appendix 2)*. Ideally, the Commonwealth purchase program would be used to at least partially address this overall water recovery target.

The Kiewa River currently has its recommended required flow components met, with the exception of freshes which are affected by the timing of hydro-power releases. While no extra water recovery is sought, the Victorian Government will continue to protect and enhance the Kiewa River through the development of local management rules (see page 64).

The Ovens River is currently considered to be in a Category 5 condition so no extra water recovery is sought. To protect this high-value river and ensure continued compliance with the Murray-Darling Basin Cap, the Victorian Government does not support enlarging Lake Buffalo (see Appendix 10). To address low flow issues in the upper Ovens, an integrated management plan is proposed (see page 65).

Comprehensive flow recommendations have not been developed for the Broken River, which will be largely unregulated following the decommissioning of Lake Mokoan. River regulation had minimal environmental impacts when the Broken River bulk entitlements were developed in 2004. As such, no extra water recovery is sought.

More detail on the 6-category approach, and the water recovery targets required to meet the different categories, can be found in Background Report 8. The environmental flow studies for each river can be found at www.ourwater.vic.gov.au/environment/rivers/flows.

Table 7.2 Water recovery targets for river systems in the Northern Region⁺

River	Water recovery target (GL)	Category under base case*	Category under Scenario D*
Murray	N/A [^]	N/A [^]	N/A [^]
Ovens	0	Category 5	Category 2 (or higher)
Kiewa	0	Category 5	Category 2 (or higher)
Broken Creek	25	Category 4 (or higher)	Category 2 (or higher)
Broken	0 [#]	Category 5	Category 2 (or higher)
Goulburn	250	Category 5	Category 2 (or higher)
Campaspe	18	Category 4	Category 2 (or higher)
Loddon	12	Category 4	Category 2 (or higher)

Notes:

+ Targets assume that the initiatives in Table 7.1 are fully implemented.

* Refer to Figure 7.2 for category definitions, Figure 7.3 for expected benefits and Background Report 8 for the full range of potential water recovery targets.

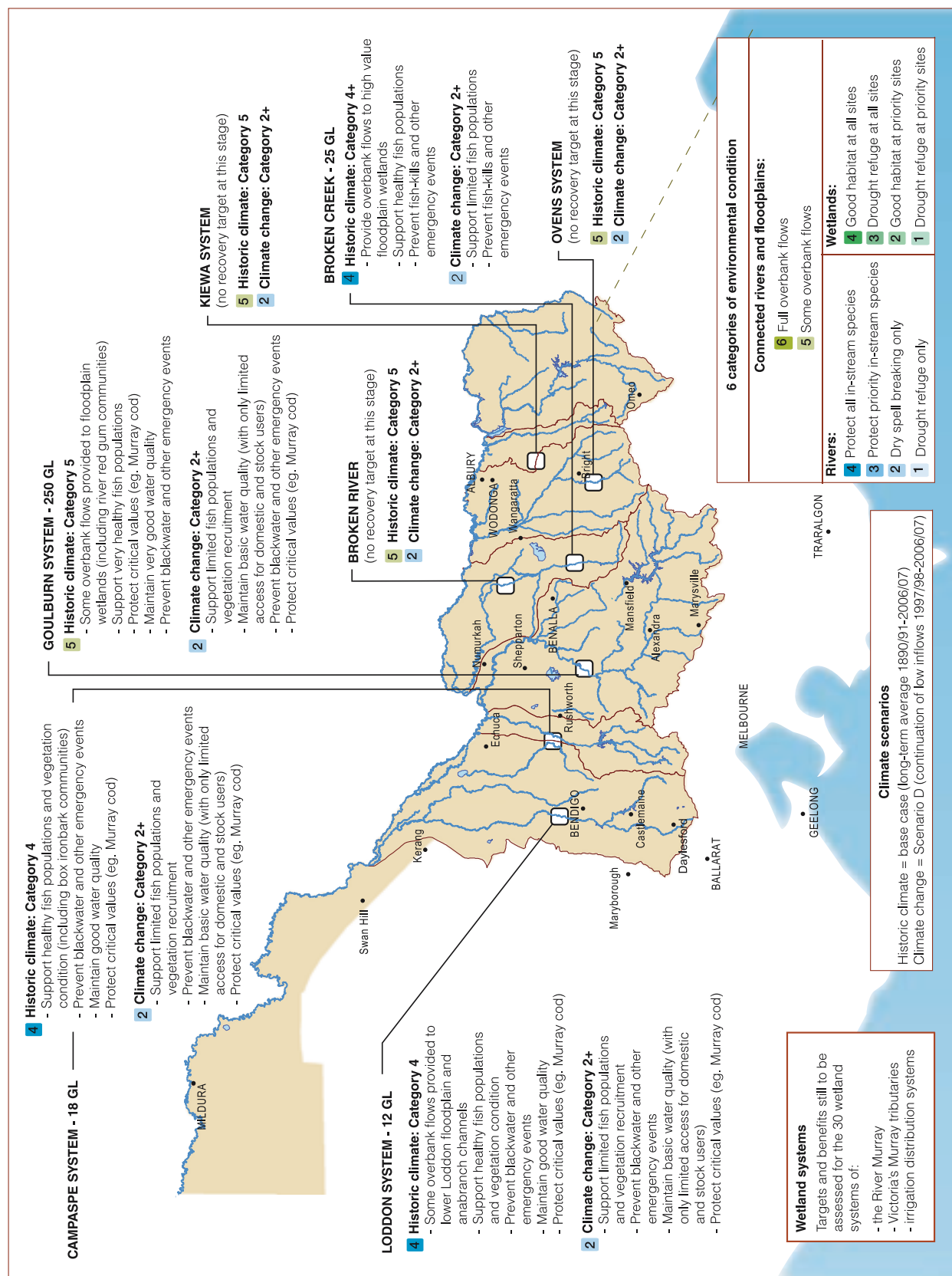
[^] See page 136 for process to assess River Murray needs.

[#] Estimation based on recent management arrangements in place and expert opinion – modelled numbers are not available due to inadequate flow data.

Footnote:

* This includes the provision of environmental flows from Snowy Water Recovery projects completed by mid-2007, and the Living Murray Initiative's 120 GL 'sales deal' and 25 GL reconfiguration savings.

Figure 7.3 Water recovery targets and expected benefits for river reaches and wetlands in the Northern Region[#]



[#] These targets assume that the initiatives in Table 7.1 are already fully implemented.

Work has begun to develop water recovery targets for the wetland systems associated with:

- the River Murray floodplain (of particular interest are those *not* identified as icon sites through the Living Murray Initiative)
- Victoria's tributary floodplain
- irrigation distribution systems.

The past 12 years have highlighted the need to prioritise sites and the increasing importance of structural works to deliver environmental water. Given the large number of wetlands in the Northern Region, it is important the right amount and mix of wetland types are chosen to invest limited resources. The focus needs to shift from managing individual wetlands to wetland systems or complexes within a broader landscape context.

400 high-value wetlands that are potentially feasible to water have been identified in 30 major wetland systems⁵⁵ (see Appendix 6). Specific processes to develop water recovery targets for these can be found in Background Report 8, but in general, the next steps are:

1. Across the region, identify the assets that we want to protect (for example, river red gum communities or migratory birds). This will be done for the next round of regional river health strategies in 2012 and will need to take into account the implications of climate change.

2. For each wetland system, identify the priority floodplains and wetlands taking into account environmental values, wetland type, number and geographic spread. The aim should be to maintain representative classes of wetlands across the region and the full range of assets identified in Step 1. The wetlands identified in this step will be the priority sites to protect under Categories 1 and 2 (see Figure 7.2).
3. Determine the water requirements (including minimum drought requirements and recommended flooding frequency) for each wetland and the works or system operating requirements to deliver water to the sites.
4. Develop water recovery targets for each wetland system. In addition, any complementary land management requirements should be identified (for example, stock fencing).

Victoria will also develop a prospectus of structural works opportunities to guide Commonwealth and State Government investment (see page 45).

Action 7.1: Water recovery targets for rivers and wetlands

Who: Minister for Water; Department of Sustainability and Environment; catchment management authorities

Timeframe: 2010

Victoria will put forward water recovery targets to guide the Commonwealth Government's \$3.1 billion water purchase program and Basin Plan.

For river systems with an inadequate EWR, water recovery targets have been identified in Table 7.2.

Where the EWR is inadequate in wetland systems, water recovery targets will be developed following community consultation, including with Traditional Owner groups. Consultation and public communication will occur through regional river health strategies. The initial objective of the water recovery targets will be the same as the river systems (that is, achieve at least Category 4 under the base case and at least Category 2 under Scenario D).

What about the River Murray 'icon sites'?

As the River Murray is a shared resource, its management is an interstate responsibility.

The environmental water requirements for the icon sites have been developed through the Living Murray process. For three of the sites (Gunbower-Pericoota, Hattah and Chowilla-Lindsay-Wallpolla), modelling has been undertaken to assess whether the 500 GL of water recovered under the 'First Step' would be adequate to meet their requirements. It also assessed whether the proposals (which include structural works to deliver water as well as a water demand) were effective under climate change scenarios.

The results so far demonstrate that under historic conditions, there is more than enough water to meet at least the minimum flow objectives of the three icon sites under medium climate change. This meets the needs of river red gums but not black box communities (which occur at higher elevations and require more water to flood). Further modelling is underway to determine for these wetlands the ability of the recovered water to meet:

- full environmental flow objectives with structural works under medium climate change
- minimum environmental flow objectives with structural works under severe climate change
- full environmental flow objectives with structural works under severe climate change (equivalent to Scenario D).

Modelling is still in progress for Barmah-Millewa and the Lower Lakes-Coorong-Murray Mouth. As Barmah-Millewa already has an environmental water allocation, Living Murray water would be used to build on outcomes from that water. If the modelling shows that water requirements are not met, it is expected that these would be considered as part of the Murray-Darling Basin Plan (see page 42). A key decision will be whether to try and retain the Lower lakes as an artificial freshwater system or allow them to become estuarine. For the remaining sites, meeting the full environmental flow objectives will continue to be a priority, given the value of the sites and existing investment in structural works.

Feedback from consultation on the Draft Strategy suggested there was a need to look beyond the icon sites. This has been particularly strong from Traditional Owner groups. In its final recommendations⁵⁶, the Victorian Environmental Assessment Council (VEAC) highlights the environmental water needs of the entire River Murray floodplain. While VEAC indicates that the optimal provision of water is through overbank flooding, it acknowledges that this may not always be feasible, particularly under climate change scenarios. VEAC recognises that structural works can provide for some targeted watering of specific sites of conservation significance. VEAC has focused its attention on comprehensive mapping of all flood-dependent ecosystems and their water requirements. This will be used in the development of water recovery and works targets to guide the Commonwealth Government's investment.

What about run-off and groundwater-fed wetlands?

The Strategy will not set water recovery targets for wetlands that receive water solely from runoff or groundwater because there is no practical means of delivering water to these sites. Many of these wetlands will no longer be high value, having been drained, used for water storages or for cropping. Where they are high value and close to distribution systems, it may be possible to build channels to supply them. In this case, their water requirements would be considered in the development of water recovery targets identified on page 133. Where they are high value but not close to distribution systems, protection could focus on informing planning decisions and preventing the drainage of wetlands. For groundwater-fed wetlands, more information will help to improve groundwater management decisions and several projects and processes are already underway, including:

- identifying the location and extent of groundwater-dependent ecosystems across Victoria and the relative importance of groundwater to these ecosystems (see page 33)
- mitigating the impacts of reduced seepage or outfalls as a result of modernisation projects (see page 113)
- considering groundwater-dependent ecosystems in the setting of groundwater trigger levels for allocations/restrictions (see page 69).

7.1.2 Efficient use of environmental water

Just as it is the responsibility of all users to ensure they are using water as efficiently as possible, so it is for environmental managers. The following sections outline several tools to improve the efficiency of environmental water use, including:

- establishing an Environmental Water Holder to coordinate its delivery across the region
- structural works to deliver environmental water
- carryover of water from one year to the next
- the reuse of return flows
- use of consumptive water en route for environmental benefits.



Horseshoe Lagoon regulator

Photographer: DSE

Establishing a Victorian Environmental Water Holder (VEWH)

There are various sources of environmental water, and entitlements are held by the Victorian and Commonwealth Governments. In the Northern Region, environmental water can be supplied to connected river systems that cross the boundaries of four catchment management authorities. To maximise the benefits of environmental water, its use must be coordinated across the whole region.

Establishing a VEWH will optimise the delivery of environmental water and direct it to its highest value use. When there is limited water available during droughts, the VEWH will be able to identify the highest priorities, having regard for catchment management authority watering proposals, and ensure that critical drought refuges across the region are protected. The VEWH will make decisions on the best use of environmental water independently from Ministers, but in line with high-level rules established by the Minister for Environment. The VEWH will coordinate the delivery of Victorian and Commonwealth environmental water (see page 52) with the Commonwealth Environmental Water Holder (CEWH).

It is important that decisions on the allocation, use and management of environmental water are made as locally as possible. The respective roles and responsibilities between catchment management authorities, the Department of Sustainability and Environment and the VEWH must be clear (see Table 7.3).

Action 7.2: Establishing a Victorian Environmental Water Holder (VEWH)

Who: Department of Sustainability and Environment

Timeframe: 2011

A VEWH will be established as an independent statutory body responsible for holding and managing environmental water entitlements and allocations and making decisions on their best use, including trade and carryover, to achieve the highest environmental value. In undertaking its functions, the objective of the VEWH will be to promote efficient investment and management to protect and enhance the value of water-dependent ecosystems throughout Victoria.

The VEWH will make decisions independently from, but accountable to, the State Government in accordance with high-level rules established by the Minister for Environment. It must have regard for catchment management authority annual watering proposals.

Legislative changes and Ministerial rules will be developed in consultation with catchment management authorities, water corporations and other relevant stakeholders. The rules will be developed by 1 July 2010 and as far as practical, will be applied to the use of environmental water across Victoria in advance of the establishment of the VEWH.

Table 7.3 Responsibilities in management of Victoria's rivers, wetlands and floodplains

Area of Responsibility	Organisaton		
	Catchment management authorities (CMAs) and Melbourne Water	Department of Sustainability & Environment (DSE)	Victorian Environmental Water Holder (VEWH)
Policy / objectives	<ul style="list-style-type: none"> • Understand ecology and values of sites • Propose environmental objectives and undertake community engagement through regional river health strategies (RRHS)* – to be endorsed by Minister for Environment and Minister for Water 	<ul style="list-style-type: none"> • Develop river and wetland management policy through Victorian Strategy for Healthy Rivers, Estuaries and Wetlands (VSHREW) – to be approved by Minister for Environment and Minister for Water • Develop water resource policy through sustainable water strategies (SWS) – to be approved by Minister for Water • Advise ministers of consistency of RRHS and VEWH watering plan with state policy • Develop rules to govern VEWH decisions – to be approved by Minister for Environment 	
Environmental water / structural works	<ul style="list-style-type: none"> • Develop environmental flow studies to identify watering requirements to meet agreed objectives of sites • Input to SWS on preferred environmental watering regime for priority sites • Identify opportunities for, prioritise local investment in, build and maintain structural works to use environmental water efficiently • Develop and publish annual watering proposals (including any structural works) consistent with RRHS, for consideration by VEWH • Negotiate system operation changes or use of consumptive water en route • Call out and deliver environmental allocations in accordance with VEWH optimised watering plan 	<ul style="list-style-type: none"> • Set standards for and fund environmental flow studies and develop the policy framework • Understand the extent that watering requirements are met by existing arrangements and identify investment priorities for water recovery through SWS • Identify investment priorities for structural works in line with VSHREW • Allocate funding to VEWH • Advise VEWH on consistency of CMA annual watering proposals with state policy and RRHS 	<ul style="list-style-type: none"> • Hold and manage environmental entitlements and allocations • Following consideration of CMA annual watering proposals, develop and publish an optimised annual watering plan for best use of environmental allocations annually (including distribution to sites, carryover and trade) • Fund the delivery, monitoring and management associated with its environmental water • Ensure coordinated use of CEWH and Living Murray Initiative allocations
Complementary restoration measures	<ul style="list-style-type: none"> • Prioritise local investment in, undertake and maintain complementary measures and ensure integration with watering 	<ul style="list-style-type: none"> • Identify investment priorities for complementary restoration measures in line with VSHREW[#] 	
Monitoring and reporting	<ul style="list-style-type: none"> • Undertake monitoring programs • Report to Minister for Environment on the benefits provided by the river and wetland activities undertaken • Provide information to the VEWH on the delivery of environmental water, including volumes, variations from the approved plan, outcomes and costs 	<ul style="list-style-type: none"> • Allocate investment in monitoring • Report to Minister for Environment and Minister for Water 	<ul style="list-style-type: none"> • Report to Minister for Environment on implementation of the integrated watering plan, including rationale for variations from CMA watering plans

Notes:

* In their next review, these will be renamed regional strategies for healthy rivers and wetlands (RSHRW).

[#] In line with the Victorian River Health Strategy prior to the release of VSHREW.

Structural works to deliver environmental water

In some instances, structural works, such as pumps and regulators, can be used to deliver environmental water and achieve environmental outcomes with much less water. This is particularly true for wetland and floodplain anabranches, which have become disconnected from the main river channels or where overbank flow frequency is inadequate to meet environmental flow objectives. Structural works offer a pragmatic supplement to overbank floods and could be a more effective alternative than purchasing water to meet environmental flow objectives, particularly if water availability is reduced as a result of climate change.

“The use of structural works to deliver environmental water becomes increasingly important under the more severe climate change scenarios and experience with The Living Murray program shows how effective they can be.”

– Draft Strategy submission DS161

Case study – structural works for Lindsay Island

Lindsay Island is a high-value floodplain ecosystem on the River Murray, just east of the South Australian border. Chapter 2 illustrated that climate change could reduce the area of river red gum forest by 72 per cent, and the area of blackbox and lignum by 85 per cent (see page 32).

A program of structural works has been developed that would allow environmental water to be delivered to 5,000 ha or 30 per cent of Lindsay Island. The \$43 million works will reduce the amount of environmental water required to flood these areas from 1,000 GL to 92 GL per watering event. The water already recovered under the First Step of the Living Murray Initiative would be sufficient to meet a 92 GL requirement. Works would be effective even with reduced river flows as a result of climate change. The works have been developed as part of the Living Murray program, however there is currently insufficient program funding to construct the works.

There is no doubt that with increasing water scarcity, structural works will be an important solution for flooding high-value floodplains and wetlands. However, while they are pragmatic when there is insufficient environmental water, potentially negative impacts need to be considered. For example, while structures provide a means to water isolated sites, they often result in a disconnection between the river and the floodplain and may act as a barrier to fish movement and migration. This reduces the ability of plant and animal populations to disperse and recolonise, and often requires the costly construction of fishways to minimise their impact and enable fish passage. Structures that disconnect a river from its floodplain also reduce carbon and nutrient exchanges with the river, which are important to maintain ecological function. As such, the decision to use structural works requires careful consideration and planning. Construction, operation and maintenance costs need to be taken into account, and the environmental benefits and potential impacts need to be evaluated.

In some instances, it may be necessary to upgrade existing water infrastructure to ensure that it is capable of delivering the environmental water required. This is particularly true for some regulating structures such as dams and weirs, which may not be capable of releasing larger quantities of water required for environmental flows. For example, a study across the Goulburn Murray Irrigation District has indicated that the outlets on the Campaspe’s Lake Eppalock would need to be upgraded to be able to deliver bankfull flows.

In identifying opportunities for structural works and infrastructure upgrades to facilitate environmental watering, each option will be assessed on its potential benefits (particularly in reducing the amount of environmental water required), feasibility and cost effectiveness.

Action 7.3: Structural works and infrastructure upgrades

Who: Department of Sustainability and Environment

Timeframe: 2010

Priority structural works and infrastructure upgrades will be developed into a prospectus for investment to complement the Strategy’s water recovery targets (see pages 133 and 135). This prospectus will be put forward to guide investment by the Commonwealth Government (see page 45) and as part of NVIRP (see page 118).

Carryover of environmental water

Flexible carryover will help to ensure a minimum supply in drought years, provide baseflows in river systems and top-up watering of wetlands for drought refuge. The introduction of SWAs reduces the risk of entitlement-holders losing their carryover in full allocation years (see page 100). It also allows water to be built up over a number of years, provided the storage does not spill. This is particularly useful for the environmental manager, who can selectively deliver high flows or floods that are not required every year.

To demonstrate this, meeting the Goulburn River water recovery target would allow the lower Goulburn River to be flooded for up to three months every three years. Modelling has shown that with current carryover rules, about 20 per cent of the three-month events are successfully completed. With the SWA, this is increased to at least 40 per cent. More liberal rules which would enable the SWA to be accessed earlier in the year, say around August, would increase this to about 60 per cent. Further detail of this analysis can be found in Background Report 7. The SWA implementation committee will assess the most appropriate spill rules. Rules that allow access as early as possible will maximise environmental benefits, but further assessment is needed to ensure this does not have unacceptable impacts on reliability.

Reuse of environmental return flows

Chapter 4 outlined new policy to allow entitlement-holders to retain ownership of their return flows and reuse them downstream (see page 84); this is particularly important for the environmental manager. When using structural works (see page 139), it takes 165 GL of water to flood Gunbower Forest for one month. But only about 16 GL of this is retained on-site; the remaining 144 GL of water flows back to river. The new policy allows environmental managers to reuse these return flows for floods and other environmental watering downstream. This significantly reduces the amount of water recovery required to meet environmental objectives.

Water quality considerations associated with environmental return flows are discussed on page 144.

Using consumptive water en route

An innovative way to achieve environmental or social benefits without requiring additional water is to make use of consumptive water – on its way to being delivered to water users.

There are many opportunities for this type of multi-benefit use of water. Natural water carriers such as rivers, creeks and wetlands are sometimes used to deliver consumptive water from storages to water users, with significant environmental benefits. Environmental water, for example, can be used to ‘piggyback’ irrigation flows to provide river red gum watering. There are also opportunities to deliver consumptive water directly through floodplain runners and even using environmental assets such as mid-river storages (for example, the Kerang Lakes), provided this takes into account the needs of both the environment and users.

Consistent with the guiding principle of the Strategy to seek multiple benefits (see page 5), system operators and environmental managers should seek opportunities to use consumptive water en route to meet ecological objectives and broader public benefits, provided that this is not detrimental to water users. It may also be possible to provide social benefits (for example, for cultural needs or recreational opportunities such as boating) without impacting on water users. These opportunities have become most apparent during the water scarcity of recent years, but they should be actively sought by water managers even during times of normal water availability.

The use of consumptive water en route reduces the amount of additional environmental water required to meet specified objectives (see page 133). In some cases, changes to system operations to provide environmental benefits may result in additional requirements for system operating water (previously known as ‘system losses’ – see page 72). In these instances and where the environmental manager agrees, it is appropriate that water from the EWR is used to cover these additional requirements.

Case study: Providing flows in lower Broken Creek

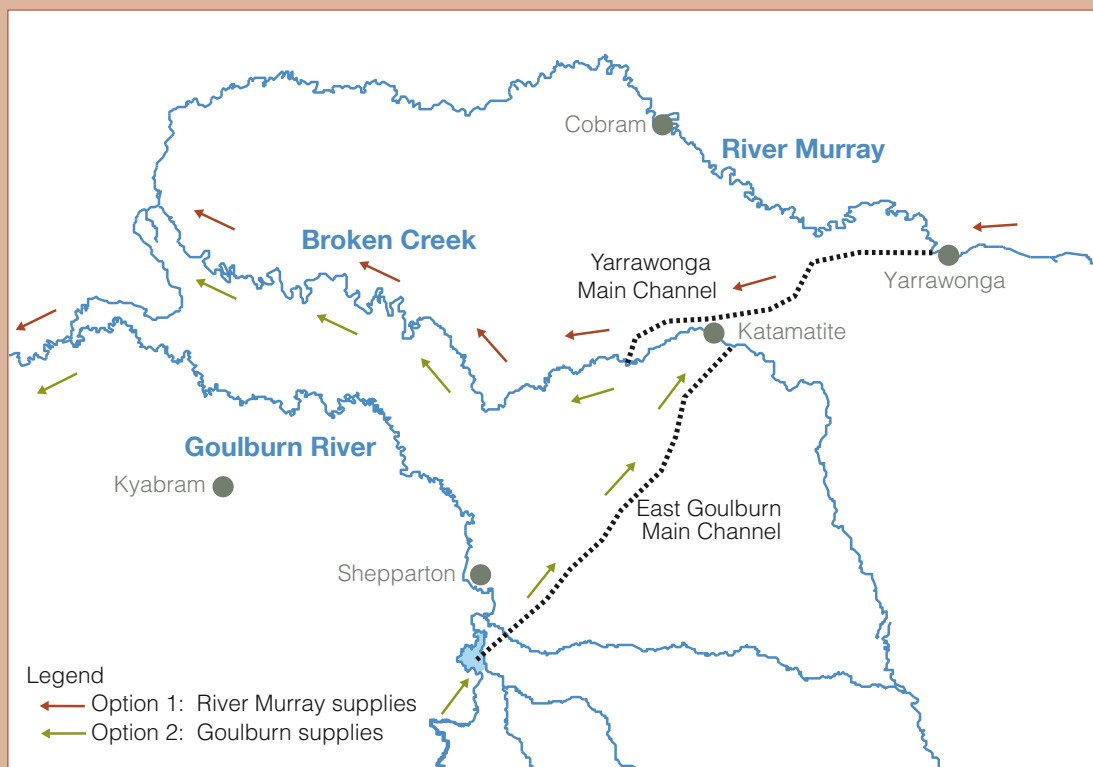
The Broken Creek breaks from the Broken River near Benalla and flows into the River Murray downstream of Barmah. The lower Broken Creek is used to deliver irrigation supplies, resulting in a changed flow pattern. Low winter flows and high nutrient concentrations are thought to result in the large accumulation of azolla (a native fern), which can lead to low oxygen levels and fish deaths.

An additional 25 GL a year of environmental flows are required to protect the in-stream environment if the historic climate continues, or maintain the drought refuges under climate change (see page 133). Instead of recovering this water through investment in water savings or purchase, it is possible to provide a large proportion of it using consumptive water en route (see Figure 7.4).

Option 1: River Murray supplies could be diverted via the Yarrawonga Main Channel, through the Murray Valley Irrigation District and down the Broken Creek before returning to the River Murray. The merits of increasing channel and outfall capacities to facilitate this could be assessed as part of NVIRP (see page 114). If feasible and cost effective, this could reduce the water recovery target for the Broken Creek from 25 GL to 8 GL.

Option 2: Water from the Goulburn system could be diverted down the Broken Creek for delivery down the Murray. Further work is needed to determine the additional losses that would need to be covered by the environmental manager and how much of the 25 GL water recovery target could be addressed by this option.

Figure 7.4 Using consumptive water en route for the Broken Creek



No formal process exists to ensure that opportunities for multi-use benefits are actively sought. Current arrangements rely on the initiative and collaboration of system operators and environmental managers. A key challenge is to develop a process that provides additional certainty to environmental managers without hindering the flexibility of system operators to adapt to changing conditions. Given the clear benefits, it is reasonable to expect that opportunities to use all water en route will be implemented, unless there is a material impact on the system operator or existing entitlement-holders.

The use of consumptive water en route for environmental and social benefit will occasionally incur additional costs. To date, these have been minor and the system operator has decided to waive them. It is expected this would continue to be the case.

Policy 7.1: Using consumptive water en route

The following principles will apply to the delivery of water for multiple benefits:

- a) Where possible all water will be managed in a manner that protects or enhances ecological values and provides broader community benefit.
- b) System operators, catchment management authorities and other interested parties will seek opportunities to use water en route to meet ecological or social objectives, provided there is no material impact on existing entitlement-holders or any other third party impact.
- c) Where there are additional defined losses and the environmental manager agrees, these will be covered by the EWR.

Action 7.4: Using consumptive water en route

Who: Department of Sustainability and Environment; catchment management authorities; rural water corporations

Timeframe: 2011

Guidelines will be prepared to formalise the use of water en route for environmental and social benefits. These will aim to provide certainty for the environmental manager, while ensuring flexibility for the system operator. They will encourage new opportunities for en route uses to be actively sought. Operating arrangements will be formalised through existing planning processes, such as the environmental programs in bulk entitlements.

7.2 Complementary restoration measures

Environmental flows are not the only factor in a healthy river, wetland or floodplain. Equally important are complementary restoration measures that protect other aspects, including water quality, riparian land and in-stream habitat. It is important that complementary measures and environmental watering are integrated and targeted to achieve the best possible environmental outcomes.

Complementary measures can include:

- revegetation of waterways to provide habitat and prevent erosion
- streamside fencing to protect habitat from livestock damage and allow regeneration
- provision of fish passage to allow breeding and recolonisation
- better management of river banks to maintain and improve water quality.

While not a substitute for adequate environmental flows in stressed systems, complementary measures can help to ensure that, where they are provided, environmental flows achieve the maximum environmental benefit possible. For example, there is little point in providing environmental flows in a river reach where there is significant habitat damage due to a lack of fencing.

Complementary works and measures are a particularly important focus in unregulated river systems where there is little scope to provide additional environmental flows. Unregulated systems account for about 26,000 km or 90 per cent of stream length in Victoria.

River health activities in each catchment are currently directed by the *Victorian River Health Strategy* and various regional river health strategies. These set long-term objectives, and priorities for investment in environmental flows and complementary measures. In recognition of the importance of complementary measures, the Victorian Government has invested \$172 million since the launch of the *Victorian River Health Strategy* in 2002 as part of an integrated program to improve the health of Victoria's rivers and wetlands.

This includes \$38 million for large-scale river restoration projects in Victoria, contributing to:

- 800-1,000 km/year of work on the riparian zone including fencing, revegetation and weed control
- 60-80 km/year of instream habitat rehabilitation (for example, fishways and reinstatement of logs)
- 40-60 km/year of stream erosion control.

In 2008, the State Government committed a further \$46 million over four years towards these large-scale river restoration works.

7.2.1 Managing water quality

The major risks to water quality are described in Chapter 2. Arrangements to address these vary depending on who can most effectively mitigate the risks or who will be most impacted. For example, irrigation activities are a significant contributor to salinity and improvements to salinity management are therefore discussed in Chapter 6. This section outlines the water quality considerations predominantly relevant to environmental managers.

Flows can be used to 'flush' a river system to manage pollution events. For example, in the Goulburn system, a 30 GL water quality contingency reserve exists to manage severe events such as blue-green algal blooms, provided conditions in the Goulburn Bulk Entitlement are met. In some instances, water being delivered to entitlement-holders could be redirected to improve water quality in an alternative route (see page 140). Where possible and provided it does not impact on entitlement-holders (for example, through increased system operating water requirements), this approach should be adopted, as it does not reduce the amount of water available for consumptive use or for the environmental manager.

If this is not possible, entitlement-holders have the discretion to use water from their own entitlements. For example, an environmental manager might use water from the EWR if there was a risk of fish deaths. An urban water corporation might use some water from their bulk entitlement if water quality was unsuitable for drinking. The Minister for Water has the power to qualify rights (see page 11) to manage a water quality problem if required, although this is intended to be a last resort.

Policy 7.2: Managing water quality

The following principles will apply when using water to manage water quality issues:

- a) The system operator will manage water quality as much as possible using water en route provided this does not reduce the amount of water provided to entitlement-holders. The system operator is obliged to work with interested parties (for example, the environmental manager or recreational interest groups) to investigate options to manage water quality in this way.
- b) Individual entitlement-holders (including water corporations or the environmental manager) have the discretion to use water from their own entitlement to improve water quality to a 'fit for purpose' standard.
- c) The Minister for Water may qualify rights (as a last resort) to provide water to manage quality, in line with the *Water Act 1989*.

Water quality risks of environmental return flows

Floods are essential to the ecological functioning of rivers and wetlands, and the return flows from environmental watering events contribute valuable energy sources to the channel ecosystem; these energy sources are particularly important for native fish populations. While these benefits are critical, it was also highlighted in the Draft Strategy that in some cases, environmental return flows may cause water quality issues. The potential risks can include increased salinity, increased nutrients, blackwater events and acid sulphate conditions. There are currently no water quality standards applicable to environmental return flows.

Further analysis has now been completed which indicates that the volume of return flows from environmental entitlements will generally be small compared to return flows from the remaining natural floods. As such, they are within the bounds of what occurs under existing conditions. Where there are water quality implications, they can be adequately managed by existing water quality processes and environmental watering programs.

Salinity impacts should be managed under the BSMS (see page 123). The impact of natural events such as floods and bushfires on drinking water supplies are managed through water corporation's water quality contingency plans. With natural events, there is generally sufficient warning time for water corporations to activate these plans. The potential impacts of return flows from environmental watering events should also be managed by these plans, provided the potential risks are identified by the environmental manager and there is good communication between the parties concerned.

Existing environmental water delivery programs analyse the potential for negative impacts of watering including salt deposits, saline or acidic wetlands and black water events. A program is then developed to minimise the identified risks where possible, and floodplain monitoring during the watering focuses on these risks. Environmental watering programs are collaborative in nature and are dependent on a close working relationship between environmental managers, land managers and water corporations. Environmental managers will continue to ensure good communication with affected parties and their obligations will be formalised through the principles in Policy 7.3.

In the longer term, water quality risks could be managed by reinstating a more natural flooding regime to improve the health of floodplains and wetlands, reducing the occurrence of conditions that favour poor water quality.

Managing impacts of acid sulphate soils

The Murray-Darling Basin Authority is conducting a Basin-wide assessment of the risks posed by acid sulphate soils, to be completed in 2010. This project was initiated because of the emergence of acidity problems caused by acid sulphate soils in some wetlands in the lower Murray area, which dried out during the drought. The project will assess the extent of acid sulphate soils and the associated risks to priority wetlands in the River Murray system, Ramsar wetlands and other key environmental sites in the Murray-Darling Basin. The project will also identify and assess options to manage risks and mitigate impacts, however, options are likely to be limited. Once sites with acid sulphate soils have been identified and the risk of acidification quantified, this information will be incorporated into future river and wetland management decisions.

Desktop assessments have already been completed to prioritise the agreed list of wetlands for further assessment. The next steps include:

- rapid assessments with field sampling of soil and water to measure pH, salinity and sulphate concentrations
- detailed assessments with additional field sampling of soil and salt crusts and preliminary laboratory tests to identify the presence of acid sulphate soils
- additional laboratory tests to assess the nature and severity of environmental risks where required.

Rapid assessments will be carried out at more than 400 sites in Victoria – over half the assessments had been completed by April 2009. Field sampling for detailed assessments has been carried out at all Ramsar sites and initial analysis has been completed. Further tests and interpretation of results are currently underway.

Policy 7.3: Water quality risks of environmental watering

The following principles will apply in making decisions about environmental watering:

- a) Environmental managers will continue to identify water quality risks associated with environmental watering.
- b) Environmental managers will identify risks to downstream drinking water supplies, determine mitigating actions where required and communicate these risks and actions to affected water corporations (or other parties as relevant, including domestic and stock users).
- c) Environmental managers will identify salinity impacts of environmental watering and manage these through Basin Salinity Management Strategy processes.

7.2.2 Protecting riparian land

Riparian land is defined as the area of land that adjoins, regularly influences or is influenced by a river. Riparian land with intact vegetation is vitally important to the health of a waterway because it provides:

- organic matter to a river, a major food source for aquatic fauna
- a supply of woody debris within the river, which forms key habitat areas for many fish and invertebrates
- a source of shade in upland areas which influences water temperature and light penetration producing suitable conditions for aquatic flora and fauna
- assistance in bank stabilisation, reducing erosion in many areas
- a buffer between the catchment and the river so it can filter nutrients and sediment
- a wildlife corridor to link habitats, especially in cleared catchments.

The *Victorian River Health Strategy* set the overall direction for the management of all riparian land and established a process for setting objectives, priorities and targets for restoration and protection. It also established catchment management authorities as the caretakers of riparian land and set direction for specific issues such as weed management.

A key impact on river health is stock watering at the river, which is allowed under Section 8 of the *Water Act 1989* without a licence or charges (see page 56). The removal of stock from the river (through fencing) may require a land-holder to find alternative watering points, especially if stock access to the waterway was the primary method of watering. In most instances, the loss of watering capacities under Section 8 acts as a deterrent for land-holders to fence and revegetate the riparian zones.

7.2.3 Safeguarding in-stream habitat

Plant and animal populations that live in rivers are affected by the physical in-stream habitat including:

- the presence of pools, riffles, cobbles and sand
- channel shape
- presence of woody debris and riparian vegetation
- connectivity and the ability for animals, organic material and sediments to move along the river and into floodplains and wetlands.

Safeguarding in-stream habitat requires decisions on how much investment should be put into preventing bed and bank erosion, restoring in-stream habitat and connectivity and the management of fish resources. This includes investment in fishways, management of non-indigenous fish, stocking and fishing. See the *Victorian River Health Strategy* and regional river health strategies for more information about safeguarding in-stream habitat (see www.ourwater.vic.gov.au/environment/rivers).



Stock watering in river

Photographer: DSE

Action 7.5: Crown frontage management

Who: Rural water corporations; catchment management authorities; Department of Sustainability and Environment

Timeframe: 2011

Programs will continue to be identified and implemented for land-holders who wish to improve land management practices and fence off riparian zones, including providing access to water for stock. The provision of water for stock will be implemented in line with the 'Policies for Managing Take and Use Licences'.

7.3 Adaptive and integrated management

Environmental objectives will not be achieved in the short term, nor is there a single solution. Figure 7.5 outlines Victoria's adaptive and integrated management approach to environmental management.

Adaptive management involves learning from management actions and using that learning to improve the next stage of management⁵⁷. It is an iterative process that requires ongoing re-evaluation. Not only does this allow the community to reassess their values and adjust at an acceptable rate, it also allows environmental managers to make more informed decisions about what is required.

Integrated management focuses on achieving environmental outcomes through an appropriate mix of environmental water, structural works to deliver water and complementary (non-flow related) measures. Each of these aspects is discussed in the previous sections.

The following sections outline how this approach will be refined by:

- adapting watering decisions to prevailing climate conditions in any year
- improving ongoing monitoring and evaluation and using this to inform policy development
- identifying a clear and transparent process to change environmental objectives if current objectives are no longer feasible under climate change.

7.3.1 The 'seasonally adaptive' approach

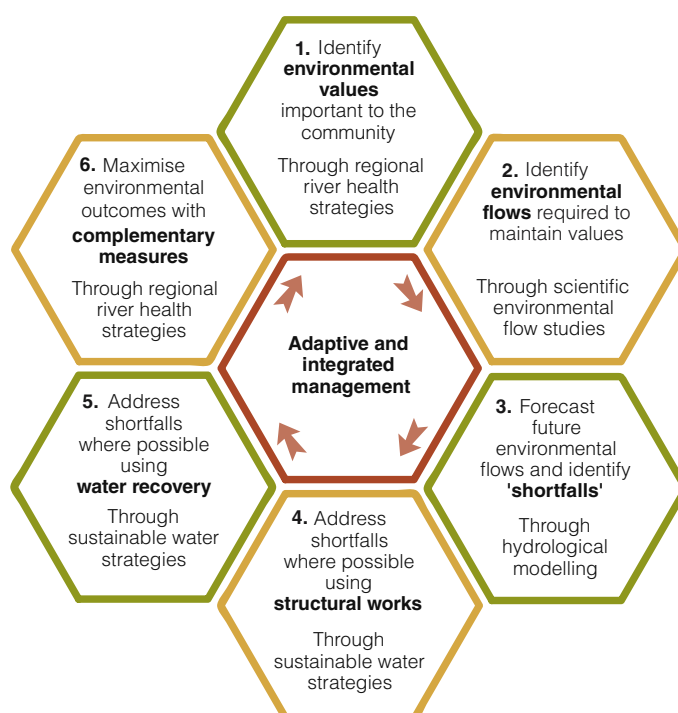
River and wetland management decisions are based on recent climate history, climate outlook and available environmental water. This Strategy outlines an approach to guide these decisions – the 'seasonally adaptive' approach (see Table 7.4). In any given year, the approach identifies the priorities for environmental watering, works and complementary measures, depending on the amount of water available. It is a flexible way to deal with short-term climatic variability.

In drought years the focus is to avoid catastrophic events, such as major fish kills, and protect drought refugia where plants and animals can survive and begin recolonisation of other areas when conditions improve. At the other end of the spectrum, in wet years the focus is to provide high flows and floods to restore values that were not maintained in drier periods, such as bird breeding events.

Complementary measures, such as additional fencing to keep out stock, may be used in drought years to protect refugia. It may also be possible to transfer animal populations to areas that can sustain them (this is known as 'translocation'). In very wet years, the focus may be on revegetation when newly-established plants will naturally receive plenty of water.

The seasonally adaptive approach is similar to the way urban water corporations change their levels of service during droughts by introducing restrictions. It helps to guide annual priorities and manage droughts, but ultimately additional water recovery may be required if water scarcity continues due to climate change (similar to supply augmentations for towns and cities).

Figure 7.5 Victoria's adaptive management approach to improving environmental values



Action 7.6: The seasonally adaptive approach to river and wetland management

Who: Department of Sustainability and Environment;
catchment management authorities

Timeframe: 2012

The seasonally adaptive approach will be incorporated into the Victorian Strategy for Healthy Rivers, Estuaries and Wetlands and the next review of regional river health strategies to guide annual planning and investment at a regional scale.

Table 7.4 The 'seasonally adaptive' approach to river and wetland management

	Drought	Dry	Average	Wet to very wet
Long-term ecological objectives	Long-term objectives to move towards ecologically healthy rivers - set through regional river health strategies and sustainable water strategies and reviewed through the 15-year resource review			
Short-term ecological objectives	<ul style="list-style-type: none"> • Priority sites have avoided irreversible losses and have capacity for recovery 	<ul style="list-style-type: none"> • Priority river reaches and wetlands have maintained their basic functions 	<ul style="list-style-type: none"> • The ecological health of priority river reaches and wetlands has been maintained or improved 	<ul style="list-style-type: none"> • The health and resilience of priority river reaches and wetlands has been improved
Annual management objectives	<ul style="list-style-type: none"> • Avoid critical loss • Maintain key refuges • Avoid catastrophic events 	<ul style="list-style-type: none"> • Maintain river functioning with reduced reproductive capacity • Maintain key functions of high priority wetlands • Manage within dry-spell tolerances 	<ul style="list-style-type: none"> • Improve ecological health and resilience 	<ul style="list-style-type: none"> • Maximise recruitment opportunities for key river and wetland species • Minimise impacts of flooding on human communities • Restore key floodplain linkages
Environmental water reserve	<ul style="list-style-type: none"> • Water critical refuges • Undertake emergency watering to avoid catastrophic events • Provide carryover (for critical environmental needs the following year) • If necessary, use the market to sell or purchase water 	<ul style="list-style-type: none"> • In priority river reaches provide summer and winter baseflows • Water high priority wetlands • Provide river flushes where required to break critical dry spells • Provide carryover (for critical environmental needs the following year) • If necessary, use the market to sell or purchase water 	<ul style="list-style-type: none"> • Provide all aspects of the flow regime • Provide sufficient flows to promote breeding and recovery • Provide carryover to accrue water for large watering events • If necessary, use the market to sell or purchase water 	<ul style="list-style-type: none"> • Provide overbank flows • Provide flows needed to promote breeding and recovery • If necessary, use the market to sell or purchase water
River and wetland catchment activities	<ul style="list-style-type: none"> • Protect refuges (including stock exclusion) • Increase awareness of the importance of refuges • Enhanced monitoring of high risk areas and contingency plans in place • Investigate feasibility of translocations • Environmental emergency management plans in place • Protect high priority river reaches and wetlands through fencing; pest, plant and animal management; and water quality improvement works • Implement post-bushfire river recovery plans 	<ul style="list-style-type: none"> • Protect refuges • Protect high priority river reaches and wetlands through fencing, revegetation, pest plant and animal management, water quality improvement and in-stream habitat works • Environmental emergency management plans in place • Improve connectivity • Implement post-bushfire river recovery plans 	<ul style="list-style-type: none"> • Protect and restore high priority river reaches and wetlands through fencing, revegetation, pest plant and animal management, water quality improvement and in-stream habitat works • Monitor and survey river and wetland condition • Improve connectivity between rivers and floodplain wetlands 	<ul style="list-style-type: none"> • Protect and restore high priority river reaches and wetlands through fencing, revegetation, pest plant and animal management, water quality improvement and in-stream habitat works • Monitor and survey river and wetland condition • Improve connectivity between rivers and floodplain wetlands • Emergency flood management plans in place • Implementation of post-flood river restoration programs

7.3.2 Ongoing monitoring and evaluation

In the longer term, river and wetland management needs to constantly adapt as we continue to learn. Adaptive management in light of new and emerging information will increase environmental outcomes. The Strategy identifies a range of actions to enhance the condition of the region's rivers, wetlands and floodplains. The effectiveness of these actions will need to be monitored and future actions improved in light of this information.

For example, the water recovery targets in Table 7.2 are based on a range of assumptions, including how existing recovery projects will be implemented, and when and where this water will be used. These assumptions may or may not be validated and this could result in the need for *more or less* water recovery. The benefits from meeting these targets are also highly dependent on climate conditions. It is important to note that, if the most severe climate change scenario prevails, managing rivers at drought flow levels (Category 1 to 2) is not a viable solution. The recovery and use of environmental water must be informed by ongoing monitoring of climate conditions and river health.

In 2008/09, the State Government committed \$1.6 million over four years to the Victorian Environmental Flow Monitoring and Assessment Program (VEFMAP). This will co-ordinate the monitoring of ecosystem responses to environmental flows in eight high-priority regulated rivers, including the Goulburn, Broken, Campaspe and Loddon systems. The result will be state-wide data to inform future management of environmental flows.

7.3.3 Adaptive management over the next 10 years

There are a number of clear milestones for adaptive management over the next 10 years (see Figure 7.6). Chapter 10 outlines the process to implement and review the Strategy. The next review is expected to be complete by 2019 before the Commonwealth Government's Basin Plan is implemented in Victoria.

A review before 2019 would also provide input to the first '15-year review'. This is Victoria's statutory long-term review of water resources under the *Water Act 1989* (see page 11). It provides an opportunity for the community to decide if it accepts the environmental impact of current water use and the appropriate action to be taken in response to climate change. This could include further increases to the EWR and/or a formal review of environmental objectives (see following section).

The 15-year review could well be the vehicle that Victoria uses to ensure compliance with the Commonwealth Government's new limits on diversions developed through the Basin Plan. Implementation of the Commonwealth's \$3.1 billion water purchase will help to ensure compliance with the new limits, but additional water recovery may also be necessary (see page 42). Preferably this would be done through the implementation of further water savings projects but, depending on the severity of the new limits, it may be necessary to resize and/or purchase additional entitlements.

It is important to note that this review is not the only solution for environmental issues. In fact, while it provides an important opportunity to take action if required, this is not the preferred avenue. A number of steps will be taken over the next 10 years to continue to improve environmental condition (see Figure 7.6). Ideally these would be sufficient with little or no action required through the 15-year review.

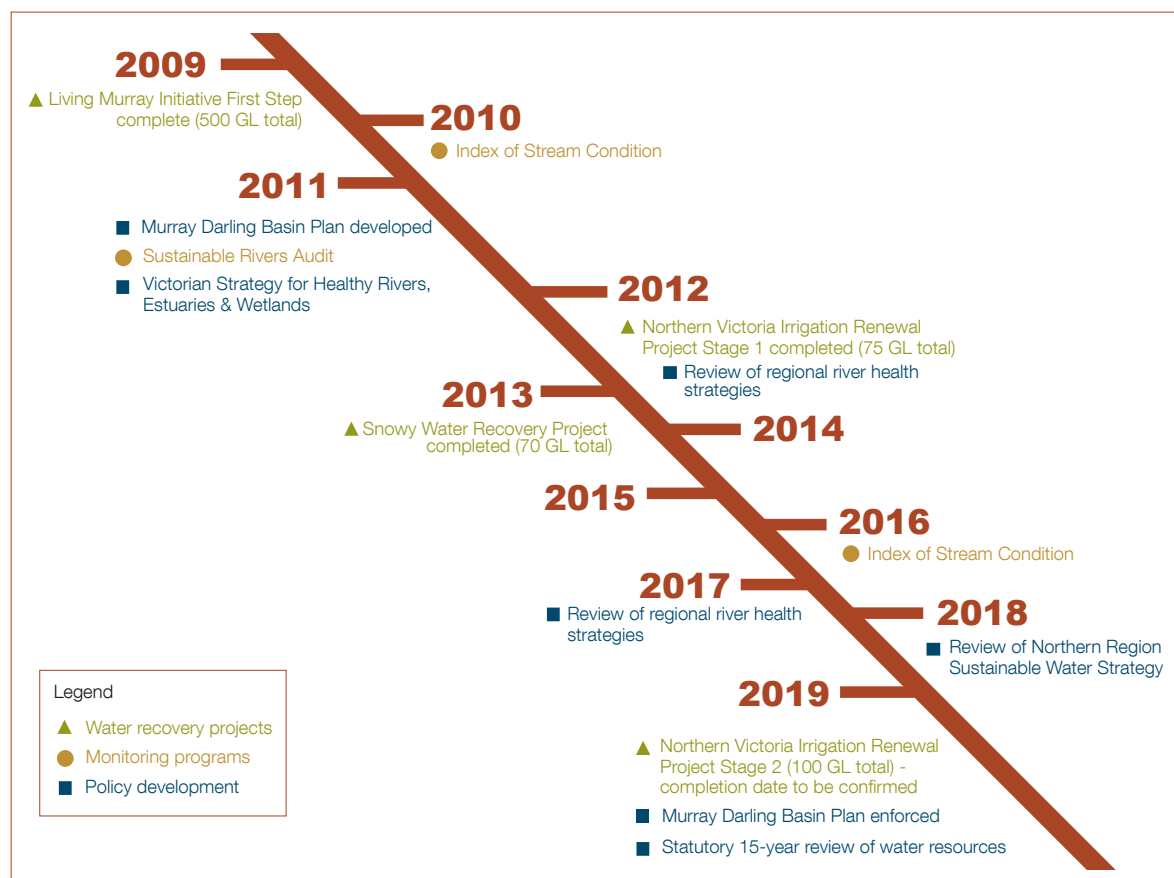
As a start, environmental water will become available from water recovery projects that are already underway. This includes 500 GL Basin-wide from the Living Murray Initiative (plus \$275 million investment in structural works), 70 GL from the Snowy Water Recovery Project and up to 175 GL from Stage 1 and 2 the Northern Victoria Irrigation Renewal Project.

The benefits of river and wetland activities, including environmental watering, will be confirmed through ongoing ecological monitoring programs. These programs will improve future management decisions. Longer-term assessments include Victoria's Index of Stream Condition and Murray-Darling Basin Authority's Sustainable Rivers Audit. These will be supplemented with annual monitoring and the coordination of environmental flows data through VEFMAP (see page 148).

All of this information, together with updated climate forecasts, will inform the review of key policy documents. The existing Victorian River Health Strategy will be replaced with the first integrated Victorian Strategy for Healthy Rivers, Estuaries and Wetlands. This will guide the next two reviews of regional river health strategies*, when catchment management authorities engage local communities, including Traditional Owner groups, to determine the environmental assets they value the most. The first reviews of regional river health strategies will incorporate the seasonally adaptive approach (see page 146), identify key drought refugia and include recent lessons about managing environmental flows through drought. Among other things, the second such reviews will prepare for the 15-year review.

Importantly, these will input to the next review of the Northern Region Sustainable Water Strategy, which will again identify ways to improve environmental outcomes, including increases to the EWR if necessary.

Figure 7.6 Key milestones in adaptive environmental management (indicative timing only)



Footnote:

* In their next review, these will be renamed regional strategies for healthy rivers and wetlands (RSHRW).

7.3.4 Process for reviewing environmental objectives

Through the development of this Strategy, the potential severity of climate change impacts has become clear – for the environment, households, urban industry, irrigators and the communities that depend on them. Chapter 9 discusses these broader community adjustment issues. As far as the environment is concerned, the following problem has become most apparent:

With climate change, there could be insufficient water to meet current environmental objectives – even if all the available water in a system is provided to the environment.

In each of the systems where analysis has been possible, the Ovens, Goulburn, Campaspe and Loddon, it is impossible to meet the full scientific recommendations (a Category 6 outcome) under the most severe climate scenario. For example, environmental water in the Loddon system could be reduced from long-term average availability of 109 GL to 17 GL a year under the most severe climate scenario (see page 24). With only 34 GL available for consumptive use under this scenario, it is impossible to compensate for the environmental reduction of 92 GL, even if the community were willing to give up all their water.

If it becomes apparent that current objectives cannot be met due to climate change, there needs to be a clear, reasoned and transparent process to change them. This must be linked to a broader review of water resource management, such as the 15-year review. Where changes are proposed to ecological objectives, the goal could still be a healthy working river but the reference point for this may change (for example, from a healthy perennial river to a healthy ephemeral river). It could entail a formal acceptance of permanent and irreversible loss of environmental assets in some areas. As such, it is important that environmental objectives are not changed prematurely.

Further work and consultation will be done as part of the Victorian Strategy for Healthy Rivers, Estuaries and Wetlands to assess the benefits of changing objectives through regional river health strategies, rather than the 15-year review.

It may also be necessary to change the environmental management objectives and watering plans of the Living Murray 'icon sites'. Similarly to Victoria's management objectives, a clear process should be identified to ensure these decisions are made when there is information to show it is warranted.

Action 7.7: Changing environmental management objectives

Who: Catchment management authorities;
Department of Sustainability and Environment

Timeframe: 2019

Should it become apparent that environmental objectives can no longer be feasibly met as a result of a long-term or permanent reduction in water availability, amendment of these objectives will be formally considered as part of the statutory 15-year review of water resources.

Regional river health strategies will be reviewed by catchment management authorities in 2011/12 and 2017/18. These will be used to consult with regional communities, including Traditional Owners, on river, wetland and floodplain values in preparation for the 15-year review and potential changes to environmental objectives.

8

This chapter outlines actions to ensure there will be sufficient water to support growth in cities and towns and meet critical human needs during drought.



Safe and reliable drinking water

Guide to the chapter

Section 8.1 How urban water supplies are managed

- Water supply demand strategies
- Drought response plans

Section 8.2 Securing supply

- Expanding the water grid
- Improved access to the water market
- Using 'fit for purpose' supplies

Section 8.3 Managing demand

- Urban conservation and efficiency
- Temporary water restrictions

What is the issue with the existing arrangements?

Secure and reliable water supplies will continue to be provided to support growth and development in urban systems, despite reduced water availability. Work is underway to secure supplies in the long term through the implementation of water supply demand strategies, while drought response plans manage water shortages resulting from short-term variability. The Strategy reinforces the importance of these planning processes which include actions to interconnect urban supply systems, improve water conservation, and invest in alternative supply programs.

The current drought has highlighted potential improvements to urban water management. To ensure critical human needs are met, the Minister for Water has 'qualified rights' in many supply systems to redistribute water to priority uses. While necessary, this introduces inequity and considerable uncertainty for entitlement-holders. The Strategy seeks to ensure secure supplies for towns and domestic and stock customers, and reduce the need to qualify rights.

What improvements does the Strategy make?

- 💧 Guides the expansion of piped supply systems for domestic and stock users to ensure reliable supplies in light of climate change.
- 💧 Introduces flexible trade and carryover arrangements so that urban water corporations can ensure sufficient supplies for urban growth and acceptable service levels.
- 💧 Allows some businesses and community groups to purchase water on the market and have it delivered by their water corporation.
- 💧 Updates drought response plans to ensure they continue to be effective in more severe and prolonged drought conditions.
- 💧 Encourages 'fit for purpose' water use, including of return flows.

8.1 How urban water supplies are managed

A secure water supply is critical to the future prosperity of the Northern Region's towns and regional centres. Climate change will likely reduce supplies for towns in the future. In addition, a growing population means that household and industry demands will increase (see Chapter 2). Water corporations and urban communities will need to be adaptive to long-term reductions and short-term fluctuations in water supply associated with a changing climate and drought.

Each urban water corporation has a water supply demand strategy to balance supply and demand over a 50-year period, and drought response plans to manage temporary shortages in supply due to drought (see Figure 8.1). These planning processes aim to provide urban water customers with an adequate level of service at a reasonable cost; generally the aim is to have restrictions in place only five or 10 per cent of the time.

The role of sustainable water strategies is to address any broader urban policy issues, including regional or state solutions that cross urban water corporation boundaries. Note that in this chapter, volumes of water are measured in ML (million litres) rather than GL (billion litres).

8.1.1 Water supply demand strategies

In 2007, urban water corporations released their water supply demand strategies, which aim to balance supply and demand in urban systems over the next 50 years (see Appendix 7 for summary). They contain a prospectus of actions that water corporations can bring forward or hold back as required to suit the water availability scenario or level of demand occurring.

For example, North East Water's water supply demand strategy forecasts that Yarrawonga's demand of 1,922 ML in 2005 will increase to 4,607 ML by 2055. At the same time, under medium climate change, its average supply yield of 1,943 ML could decrease to 1,542 GL. Table 8.1 outlines the key actions identified to meet the resulting shortfall of 3,065 ML. These actions aim to either increase supply or reduce demand to address this shortfall.

Water supply demand strategies are prepared every five years to take account of system augmentations, updated supply scenarios, demand forecasts (including population estimates) and changes to agreed serve levels. Their next revision is due to be completed in 2012.

Figure 8.1 The relationship between short and long-term planning for urban water supplies

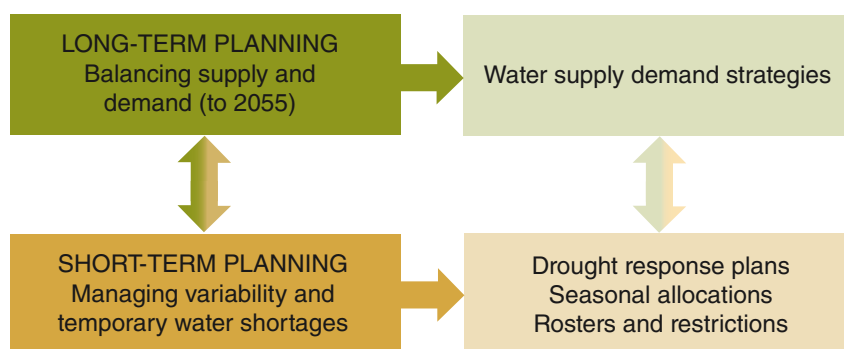


Table 8.1 Ensuring sufficient supplies in Yarrawonga through a water supply demand strategy⁵⁸

Action identified to address shortfall of 3,065 ML*	Volume provided (ML)
Using the market to purchase water entitlements	1,700
Improved system operations (including leak detection, reuse of backwash, improved metering)	620
Demand reduction (including customer advice, incentives and restrictions)	490
Self-reliant households (including rainwater tanks and greywater reuse systems)	240
TOTAL	3,100

Note:

*Assumes Scenario B (medium climate change) water availability.

8.1.2 Drought response plans

Urban water corporations have drought response plans to manage temporary water shortages resulting from prolonged periods of below average rainfall. These plans provide the basis to implement the four stage uniform water restriction schedule, developed for application across Victoria. As restrictions increase from Stage 1 to Stage 4, outdoor water use is progressively restricted. Restriction decisions take into account projected water availability and the effectiveness of restrictions in reducing demand. The drought response plans also contain contingency actions to further reduce demand and/or augment supplies. They may in some cases bring forward actions in the water supply demand strategies to permanently increase supplies.

The past 12 years of ongoing low inflows (with little storage recovery) have already resulted in a number of towns experiencing prolonged high water restrictions, affecting individuals, businesses, community values and industry. Where the highest level of restrictions (Stage 4) has been insufficient to maintain a supply/demand balance, additional contingency measures have been required for many systems. Some, such as increasing the network of emergency water cartage points, are temporary. In other cases, for example accessing additional groundwater supplies or system interconnections, the augmentations will enhance future supply reliability.

Where a water shortage has been declared, the Minister for Water has qualified rights, redistributing water from some entitlement-holders to supply critical human needs (see page 11). However this process advantages some water users at the expense of others and is only enacted as a last resort.

Climate change is expected not only to reduce the overall availability of water supplies, but also to increase the frequency and duration of drought periods.

In order to maintain an acceptable level of supply reliability, drought response plans need to be updated to ensure consistency with longer-term planning in water supply demand strategies, which consider a range of water availability scenarios. Specifically, the plans need to take into account any recent system augmentations and operational changes, incorporate lessons learnt from managing the current drought, and include more detailed contingencies for further reducing demand and/or augmenting supplies if the highest level of restriction is not sufficient. Appropriate lead times for implementing contingency actions must also be allowed for. It is expected that revised drought response plans will have sufficient contingencies to minimise the need to qualify rights.



Bowling club bore water, Violet Town

Photographer: Bruce Cumming

Action 8.1: Updating drought response plans

Who: Urban water corporations; Department of Sustainability and Environment

Timeframe: 2011

Drought response plans will be updated to:

- examine the responsiveness to a range of water availability scenarios including a continuation of recent low inflows (Scenario D)
- incorporate all the necessary contingencies to augment supplies and further reduce demand to address or manage supply shortfalls
- ensure adequate consideration of the lead times involved in implementing contingency actions
- incorporate recent system augmentations and operational changes including piped domestic and stock water supply systems and use of carryover
- provide specific guidance on when restrictions will be eased or lifted.

8.2 Securing supply

Accessing additional water supplies will help to future-proof urban supply systems against growing demands and a future of less water availability.

8.2.1 Expanding the water grid

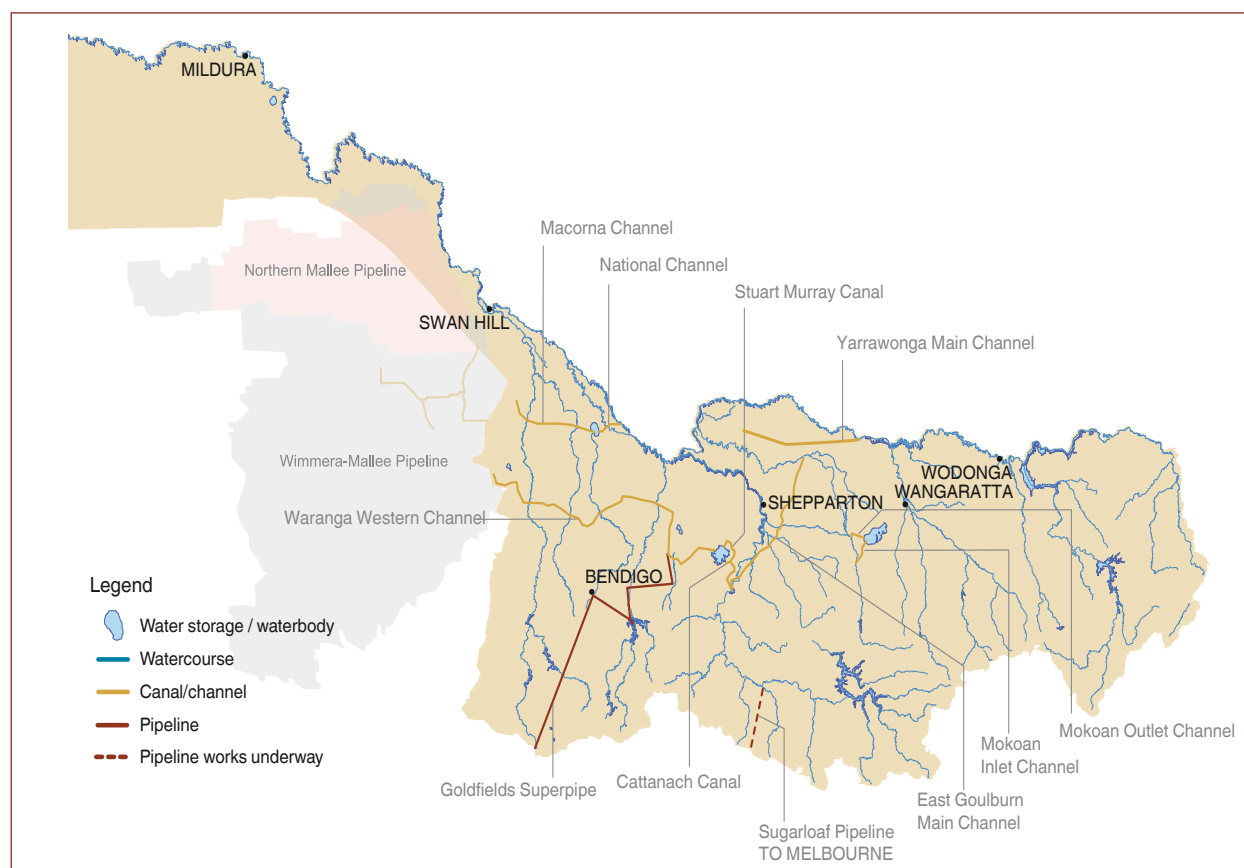
The 'water grid' is the system of rivers, channels and pipes that distribute water for irrigation, urban and environmental needs. The grid has been gradually expanded over the past 100 years or so and will continue to be expanded to allow better risk management in light of a drier climate.

These interconnections will be particularly important to provide reliable urban and domestic and stock supplies.

Connecting systems to supply towns and cities

The water grid will facilitate and support effective trade and carryover for urban water corporations. Together, all three will enable towns and regional centres to secure their water supplies, and support the continued growth of regional centres and urban industries. Recent expansions of the grid, including the construction of the Goldfields Superpipe to connect Bendigo and Ballarat to the Goulburn system, have averted potentially catastrophic failures in town water supplies (see Figure 8.2).

Figure 8.2 Major interconnections in the Northern Region



Case study: Axedale pipeline

Following the completion of the Goldfields Superpipe, Coliban Water has completed an 11.7 km pipeline to connect Axedale to Bendigo's water supply system and the wider Victorian water grid. This provides the town with the option of purchasing water to help improve water supply reliability and quality.

Axedale's 120 residents traditionally drew water from the Campaspe River, but water quality and availability due to drought have been so severely affected that Coliban Water has been carting in 0.05 ML (50 kilolitres) a day for the past 18 months.

Coliban Water will now focus on other high-priority towns, including connecting Raywood and Sebastian to Bendigo water supply systems. There may also be opportunities to connect to Bendigo's recycled water pipeline, which runs from Epsom and Spring Gully, to substitute potable demand for non-drinking purposes.

Expanding domestic and stock reticulated supply

With reduced water availability, domestic and stock dams will be less reliable. Water users that currently depend on these dams will need to investigate alternative supply options. In addition, modernisation will result in some irrigation channels being closed down (see page 113). Rural and urban water corporations will need to consult with affected domestic and stock customers about alternative supply options. Expanded reticulated (piped) urban

and rural supply systems will become an important source of water for domestic and stock purposes. Piped supplies are often a more efficient supply than dams or channels as they result in fewer losses. The expansion of reticulated domestic and stock systems will be mainly investigated by rural and urban water corporations to ensure a consistent approach. Water corporations should include a number of important considerations, such as alternative supply sources, local climatic conditions and level of service required in their planning processes.

Action 8.2: Expansion of reticulated systems for domestic and stock use

Who: Rural and urban water corporations; Department of Sustainability and Environment **Timeframe:** 2012

A consistent approach will be developed to manage the expansion of reticulated domestic and stock supply systems, taking into consideration:

- cost effectiveness
- who will provide the service (that is, an urban or rural water corporation or community co-operative)
- whether the service is required for one customer or a group of customers
- required level of service (that is, the water quality required and whether the supply is needed only for the irrigation season or for the whole year)
- proximity to existing supply systems
- terms and conditions for the customer and how to determine a fair and reasonable price.

Pricing arrangements will need to be consistent with the Essential Services Commission's existing pricing principles and any future principles developed as part of a state-based third party access regime.

8.2.2 Improved access to the water market

Regional urban water corporations in northern Victoria have already participated in the water market to address water shortfalls and to sell to rural users. To achieve a balanced approach to water management, trading is only one of a number of measures used to manage supply and demand. Conservation and efficiency, carryover and the use of alternative water sources are examples of other measures.

Carryover and trade are important tools that urban water corporations will continue to use to secure sufficient supplies during temporary water shortages and to manage the long-term impact of a drier climate and population growth. For towns such as Kyabram that are supplied by the irrigation distribution system, the usefulness of carryover and trade is entirely dependent on the system being operated in extreme droughts. To ensure this, Chapter 5 outlined actions to secure operation of the distribution system (see page 88).

Carryover and the spillable water account

Chapter 5 described how carryover and trade allow all entitlement-holders to manage the risks of variable water availability. In March 2009, it was announced that entitlement-holders could carry over up to 50 per cent of their entitlement volume into the 2009/10 season. This was an important change for some urban water corporations who require this amount of carryover to ensure that critical human needs can be met. But the change also presented some additional risk. The rules mean that carryover water would be lost to the system reserve if full allocations were made in the following season. As with all entitlement-holders, forfeiting a 50 per cent allocation is a significant cost for urban water corporations, which would be passed on to customers.

To reduce this risk of forfeiting allocations, the Strategy introduces the 'spillable water account' (SWA), which allows entitlement-holders to store additional carryover water, only forfeiting it when it physically spills from the storage*. Introducing the SWA significantly reduces the risk of all entitlement-holders losing what they carry over. For urban water corporations it protects their investment in water purchases and should reduce customer charges.

Trade for community groups and businesses

In recent years, there have been calls for urban customers to have greater access to the water market. Accessing water through the market could ease the impact of water restrictions on community facilities such as sports grounds, and businesses and industries that rely on outdoor water use. In response, North East Water instigated a pilot 'urban water trading' project developed as part of the Victorian Government's drought response package. The pilot allowed community groups and businesses that met special criteria to purchase additional temporary water on the open water market.

Case study: Water trading by an urban customer

In February 2008, North East Water had to introduce water restrictions to ensure there was enough water for its customers. Stage 4 restrictions in Wodonga meant that many sporting ovals had become unfit as playing surfaces. The Wodonga Senior Secondary College oval plays an important role in the community. It services secondary students, and community members who play a range of sports on the oval each week. In response to the water restrictions, the Wodonga Senior Secondary College invested in a more efficient watering system, and re-turfed with a drought-tolerant type of grass. However, low rainfall, resulting in empty water tanks,

meant the grass could not be watered in its first week, after which it would have been sufficiently established to survive.

The school was an ideal candidate for North East Water's pilot 'urban water trading' project. Through North East Water, Wodonga Senior Secondary College purchased 11 ML of water for the critical first week of watering for its new turf. As a result, the school children and other community groups could play sport and undertake other activities on a safe playing ground.

Footnote:

* For storages on the Murray system, this includes an internal spill from Victoria's share of the storage.

Since the success of North East Water's pilot project, other urban water corporations in the Northern Region have used this concept. North East Water, Coliban Water, Lower Murray Water and Central Highlands Water have all purchased some water on the open market on behalf of customer groups. The following principles are generally applied to the purchase program:

- a) Eligibility is limited to community organisations where water is used to maintain community facilities and small businesses able to demonstrate financial loss as a result of ongoing water restrictions.
- b) Customers pay the full price of water delivered through the reticulated system, in addition to the market price for the water.
- c) Only 80 to 90 per cent of water purchased is delivered to allow for treatment and system operating requirements.
- d) Participants are required to adhere to efficient water use practices

It has been argued that all urban customers should be able to access the water market. However, residential customers and small businesses are generally excluded due to the considerable administrative process and costs that would be required to establish and monitor all trade and use. Further work will be done to investigate the possibility of all urban customers accessing the water market, including the:

- likely demand for such a service by individuals
- administrative processes required to keep track of trades (including linkages with the Victorian Water Register)
- impact on the effectiveness of restriction policies in balancing supply and demand and on policing compliance with restrictions
- community response to allowing some customers to use the water market to avoid water restrictions.

It is important to emphasise that urban water corporations are still expected to provide a minimum level of service to all their customers.

Policy 8.1: Enabling urban customers access to water markets

Regional urban water corporations are responsible for providing a minimum level of service (as specified in their water supply and demand strategies and drought response plans) to all their customers.

In providing the minimum level of service, water corporations should consider all viable options including the water market.

Facilitated access and direct access to the water market by all customers may occur subject to a range of policy issues being investigated and addressed – including the terms and conditions of access and assessment and establishment of an access regime, likely demand for access, administrative and decision-making responsibilities and processes, equity considerations, and community views.



Football match, Violet Town

Photographer: Bruce Cumming

Under current arrangements, water purchased on the market cannot be delivered through water corporation works without agreement to terms and conditions, known as a third party access regime. The regime is designed to provide certainty as to rights of access, conditions of water delivery, prices and other arrangements. As recommended by the Victorian Competition and Efficiency Commission⁶⁹, the State Government has asked the ESC to undertake an inquiry into the development of a state-based access regime, including consultation with stakeholders. A particular issue for consideration by the ESC is how new services are to be regulated, and ensuring customers are provided with appropriate levels of assurance and protection in the delivery of those services.

Experience in Victoria and interstate indicates that there is a demand for innovative water and sewerage services, and that there are operators potentially interested in providing such services. A third party access regime would enable businesses and other parties to access the water and sewerage infrastructure of water corporations to provide a broader range of services.

8.2.3 Using 'fit for purpose' supplies

Using alternative sources that are 'fit for purpose', that is, of an appropriate quality for its intended use, can help reduce reliance on water from rivers and reservoirs. In light of the expected reduction of traditional water sources as a result of climate change, individuals, households, businesses and water corporations should continue to explore opportunities to use alternative sources. These should be implemented where cost effective and practical and where possible, high-value uses should be encouraged over low-value uses, returning higher value to urban communities. The Victorian Government will continue to encourage the use of alternative sources.

Large-scale recycled water use

The reuse of treated water from sewage treatment plants is common throughout the region. Agricultural reuse is prevalent because water quality requirements are less stringent than for urban use and therefore lower in cost. For example, Class A, B, C or D recycled water can be used, subject to conditions, for non-food crops, woodlots, turf and flowers. The potential to implement further high-value agricultural reuse should be investigated, especially with reference to creating new 'food bowl' areas close to a reliable source of water. There is also potential to increase reuse for industrial and urban applications and to use recycled water more efficiently.

Chapter 4 outlined new policy to allow entitlement-holders to retain ownership of their return flows, rather than losing them to the communal resource (see page 83). In the case of urban water corporations, water from sewage outfalls could be delivered downstream to other customers via the river and irrigation distribution systems. Enabling urban water corporations, as individual entitlement-holders, to reuse or trade their return flows will be important in achieving the maximum value of recycled water. For example, a water corporation may decide to upgrade a water treatment plant to supply downstream users with better quality recycled water via the waterway. This could replace investment in an expensive dual pipe system.

Large-scale stormwater use

Urbanisation significantly alters both the quality and quantity of water that is delivered to receiving waterways. Large peaks of stormwater from rainfall running off impervious surfaces can cause pollution events, that is, elevated concentrations of nutrients and contaminants in waterways. Better management at the source, for example using activated charcoal to treat sewage outfalls to prevent blue-green algal blooms, can reduce the impact of these events. Harvesting stormwater at the allotment and street scale in urban areas provides an alternative source of water and improves stream health.



Hepburn Springs

Photographer: Visions of Victoria

Case study: Water conservation and recycling for Bendigo Hospital

Bendigo Health Care Group have recently completed a project that is anticipated to save up to 32 ML of potable water per year at the Bendigo Public Hospital and associated health care facilities.

The project involves an all-round approach to water savings through water conservation and reuse. Sources of water include rainwater, stormwater, and water recovery using reverse osmosis technology, from on-site industrial waste processes. Industrial wastewater comes from nursery drainage, kidney

dialysis, laundry washes, evaporative cooling and weekly testing of the hospital's fire sprinkler system. Restrictors were also installed in showerheads and tap outlets.

The collected water is being used for garden irrigation, toilet flushing and car washing. The on-site car washing facility at the John Bomford campus helps in the rehabilitation of psychiatric patients who are able to wash cars to earn income before returning to the community.



Water conservation and recycling for Bendigo
Photographer: Bendigo Health Care Group

Household-scale schemes

Rainwater tanks collect and store rainwater from roofs for household use on gardens and inside the house, for example, toilet flushing and clothes washing. Householders benefit from reduced water bills and an alternative water supply for outdoor use during water restrictions. The State Government continues to encourage Victorians to use alternative water supplies for non-drinking uses where there is a net benefit to the community and to minimise detrimental discharges to the environment.

The use of other on-site stormwater management devices such as collecting runoff from roof areas and paving, infiltration systems and rain gardens (that is, garden beds that act as a biological filter), can also go some way in reducing the current amount of run-off and pollutants leaving a site.

Greywater reuse at the individual household level reduces demand on potable water supplies for garden watering. The Water Smart Gardens and Homes Rebate Scheme provides rebates of up to \$500 for greywater systems and rainwater systems (see www.ourwater.vic.gov.au/saving/home/rebates).

8.3 Managing demand

Managing demand is an important way of reducing the cost or need for supply augmentations in a system. As with rural users and the environment, urban users have a responsibility to use water efficiently.

8.3.1 Urban conservation and efficiency

The State Government is committed to ensuring water conservation measures are implemented by households and industries throughout Victoria. This has been shown to be a cost-effective and energy-efficient way to save water.

The current drought conditions have increased awareness of the need for water conservation in urban areas. Associated behavioural change has already contributed to a reduction in average per capita water

use since the 1990s. To encourage conservation in the long term, each urban water corporation has established targets of 10 to 32 per cent reduction in per capita consumption by 2055. Per capita consumption is measured in litres/person/day and includes residential, non-residential and non-revenue components of water use. The specific targets, and the programs to meet them, can be found in each water corporation's water supply demand strategy.

Urban water corporations will continue to work with householders and industry to encourage adoption of water conservation practices, and will improve their data and understanding and monitor progress towards targets. Table 8.2 summarises the conservation actions of each urban water corporation and the estimated savings to 2055.

Table 8.2 Major conservation actions from urban water supply demand strategies

Water corporation	Conservation action	ML/year
North East	Demand reduction and management (Wodonga)	1,200
	Demand reduction and management (Wangaratta)	750
	Demand reduction and management (Yarrawonga)	490
	Delivery system performance (Yarrawonga)	620
	Self-reliant households (Wodonga)	690
Goulburn Valley	Major industry resource efficiency program	1,380
	Reduction in non-revenue water program	800
	Indoor appliance upgrades	760
	Four star washing machine replacement program	460
	Basix house sustainability tool program	310
Coliban (Coliban system)	Rural reconfiguration	4,000
	Urban leakage control	1,400
	Permanent water savings measures	1,000
	Non residential conservation programs	700
	Community education programs	350
Central Highlands*	Leakage prevention and reduction (unaccounted water strategy)	N/A
	Development and implementation (eg. retrofitting and rebate programs)	N/A
	Residential water conservation (eg. retrofitting and rebate programs)	N/A
	Community and school education programs	N/A
	General water saving promotions, events and information	N/A
Lower Murray	Customer education and awareness program	1,000-2,000
	Implementation of efficient garden program	
	Promote water efficient appliances	
	Leakage detection program	500
	Saving water in industrial and commercial businesses	1,000

*Conservation estimates are calculated by system, with a projected total savings of 521 ML/year.

Non-residential use (comprising industry, commercial/institutional buildings and open spaces such as parks and gardens) accounts for one-third of urban water use in the Northern Region. The Victorian Government is supporting water conservation by industries and businesses through the state-wide implementation of WaterMAP. Non-residential customers that use greater than 10 ML a year are required to develop a water management action plan (WaterMAP) with an indicative target of 10 per cent improvement in water efficiency (see www.ourwater.vic.gov.au/saving/industry for more information).

Another measure to reduce water demand was the introduction of permanent water saving rules for urban water supplies in 2004. These are common sense measures to promote urban water conservation and efficiency. The rules include a ban on the hosing of footpaths and requiring trigger nozzles to be attached to hoses and they apply every year all year round. The current rules apply to reticulated urban supply systems, but do not apply to water supplied from groundwater, unregulated or regulated supplies. It makes sense to eliminate wasteful practices regardless of the source of water.

8.3.2 Temporary water restrictions

The application of water restrictions in accordance with drought response plans has been effective in balancing urban supply and demand during droughts (see page 154). However, they come with social and economic costs, particularly at the highest level of restriction. Stage 4 restrictions ban all outdoor use and as a result, negatively affect community facilities, such as sportsgrounds, and businesses that rely on outdoor water use. In recognition of this, some exemptions from Stage 4 restrictions have been granted, but the consistency of these exemptions across Victoria needs to be improved.

It is likely that the number of properties with stock or rural industry needs connected to urban systems will increase with a drier climate. This would place additional demand on supply systems, particularly during droughts as customer water demands are high. Under current arrangements, this stock and rural use is treated as industry and as such, is not subject to the standard urban water restrictions. Drought response plans need to consider applying restrictions to these new demands.

Under continued water shortages, more people are turning to groundwater sources to water gardens during periods of severe water restrictions. Having dual supplies (that is, access to both rural and urban supplies) raises equity issues where customers may be able to avoid the most severe impacts of water restrictions. However, there may not be any stress on groundwater supplies in the urban area under water restrictions. Therefore, groundwater supplies will not be restricted in line with urban supplies, unless required to protect the groundwater resource (see page 69).

Action 8.3: Expanding water conservation measures

Who: Urban water corporations; Department of Sustainability and Environment

Timeframe: 2011

WaterMAPs will be required to be developed by any non-residential customer using more than 10 ML/year who connects to the urban supply system.

The capacity to apply permanent water savings rules to all water sources will be investigated, including regulated, unregulated and groundwater sources where users have access to reticulated supplies.

Action 8.4: Updating the uniform water restrictions schedule

Who: Urban water corporations; Department of Sustainability and Environment

Timeframe: 2013

The uniform water restriction schedule will be reviewed to:

- build on the lessons learnt from recent dry conditions
- improve consistency in the application of exemptions across Victoria (when appropriate)
- consider the need to apply water restrictions to domestic and stock customers and rural industry when connected to the urban supply system.



9

This chapter highlights opportunities for community involvement in water and summarises how the community will be supported in adjusting to water scarcity.

Prosperous, dynamic and resilient communities

Guide to the chapter

Section 9.1 Community involvement in water resource planning

- Indigenous involvement

Section 9.2 Supporting communities through structural adjustment

- Encouraging community development

What is the issue with the existing arrangements?

Decisions about water can affect almost every aspect of our lives, including our health, regional economies and the environment. Community involvement in these decisions is essential. Communities are undergoing considerable adjustment as a result of prolonged drought and potential climate change and the transfer of water from consumptive use to the environment.

What improvements does the Strategy make?

- 💧 Highlights the range of processes where community members can get involved to ensure their values are reflected in decisions about water.
- 💧 Encourages greater Indigenous involvement in water resource planning by establishing a scholarship and cadetship for young Indigenous leaders.
- 💧 Outlines Victorian Government programs supporting regional communities.

9.1 Community involvement in water resource planning

Water affects almost every aspect of our lives; it underpins our health, regional economies and the environment. Decisions about its management can affect the very fabric of our communities and therefore it is critical that community members get involved in water resource management. Community involvement ensures that decisions about water resource management reflect community views and support the values that communities deem most important.

There are several processes where community members can contribute to water planning in their area (see Figure 9.1), which:

- cover all aspects of water resource management, including rural and urban supplies and the environment
- prepare for a range of timeframes, from one to 50 years
- plan for a variety of geographic scales from specific systems through to Basin-wide arrangements.

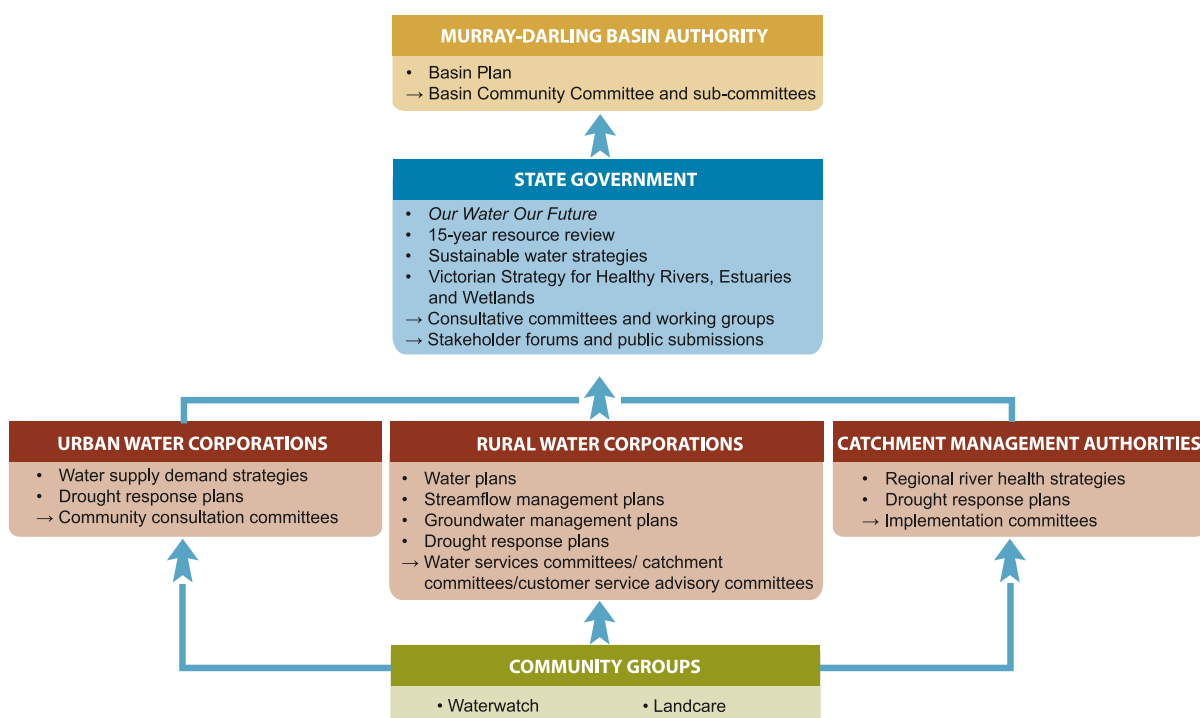
To find out how you can get involved, contact your local water corporation, catchment management authority or other relevant organisation. See page 173 for contact details.

9.1.1 Indigenous involvement

Water is a fundamental, life-giving source that is at the heart of Indigenous culture. Indigenous people in the Northern Region have distinct cultural perspectives and want to be more involved in water resource decisions and processes. Background Report 11 has more details of these aspirations. There are several ways this can be achieved:

1. **Improved funding and resources:** Most Traditional Owner organisations in the Northern Region do not have adequate funding to be able to respond to and engage with government decision-makers. Funding is required to establish viable and effective organisations that can engage with governments and the wider community on water management decisions.
2. **Forums for decision making:** Indigenous people have traditional rights to care for Country which have historically been undermined. In order to exercise these rights, Traditional Owners need to be involved in decisions about water management on an ongoing basis.
3. **Informed input:** The introduction of information exchange forums will facilitate contact and information sharing between Traditional Owners and land and water managers and provide greater understanding of the cultural aspects of water management.

Figure 9.1 Community involvement in water resource management – key planning documents and consultation processes



4. **Skill development:** Traditional Owners in the Northern Region have identified the need for greater professional and skills development within their communities. Traineeships and scholarships related to water management are two options, as well as increased employment of Traditional Owners in water management agencies, including contractual work. Further professional development and training is also important.
5. **Supporting connections to Country:** Traditional Owners in the Northern Region currently own only a small percentage of their traditional lands and many aspire to owning more of their Country. This could be facilitated through existing land/water purchase programs (see page 45). In the Northern Region, no new entitlements can be issued due to the Murray-Darling Basin Cap but existing entitlements can be purchased by Indigenous people.

“Appropriate resources should be allocated to Traditional Owners to be involved in these processes...”

– Draft Strategy submission DS164

Many Traditional Owners are interested in understanding how river flows can meet cultural needs. In 2007, members of the Murray Lower Darling Region Indigenous Nations met in Echuca and agreed to a preliminary definition of cultural flows. The Echuca declaration⁶⁰ will help water managers to gain a basic understanding of cultural flows, however further work is needed to consider the aspirations of individual Traditional Owner groups.

Catchment management authorities are a key link for Indigenous groups to become more involved in water resource planning. When reviewing regional river health strategies (see page 149), the RIVERS assets register will be improved to help catchment management authorities and their communities document values associated with the region's rivers, floodplains and wetlands. By recognising and communicating the social, cultural, economic and environmental values, they can provide input into further decisions on water recovery targets and annual watering plans.

In June 2009, the Victorian Government announced that the *Victorian Native Title Settlement Framework* would become the preferred method for negotiating native title settlements over land and water in Victoria⁶¹. Developed in collaboration with the Victorian Traditional Owner Land Justice Group, the framework aims to make it easier for groups to resolve native title claims, while building strong partnerships and creating economic opportunities. The framework will be important for identifying and progressing Indigenous people's aspirations for managing water resources.

Action 9.1: Indigenous involvement in water management

Who: Department of Sustainability and Environment; catchment management authorities

Timeframe: Ongoing from 2010

Education, training and capacity building for Indigenous people will be improved by inviting Traditional Owners to nominate young leaders to be involved in:

- a scholarship for the biennial Graduate Certificate of River Health offered by Melbourne University
- an annual cadet position within the Department of Sustainability and Environment's Office of Water/regional offices or catchment management authorities.

Indigenous involvement in decisions about water resources will be improved by:

- providing regular regional forums for information exchange between catchment management authorities and Indigenous groups
- establishing key positions for Traditional Owners on regional water resource decision-making committees
- providing funding to Traditional Owners to facilitate capacity building and participation in meetings and committees.

9.2 Supporting communities through structural adjustment

Structural adjustment refers to changes in the distribution of activity and resources among businesses, industries and regions⁶². It occurs as a result of natural economic, social and environmental factors (such as changes in demand for goods) and as a result of government policy (such as the Murray-Darling Basin Plan).

Structural adjustment is the cumulative effect of countless decisions that individuals, businesses and governments continuously make in response to changing conditions. It is occurring all the time and it is an integral part of ongoing social and economic development.

Some of the changes experienced in northern Victorian communities as part of structural adjustment include:

- declining population in some small towns with growth in larger regional centres
- farms close to regional centres being subdivided and purchased by people who rely on off-farm income
- retirement of salt-affected or unproductive land
- aging population profile, particularly of farmers who are deciding to retire
- consolidation of properties, with increasing size and corporatisation
- significant investment in agricultural ventures from non-agricultural sources
- changing farming enterprises and practices in response to water scarcity and changing cost structures and commodity prices.

This Strategy considers the structural adjustment that is occurring in the irrigation sector as a result of:

- prolonged drought and potential climate change (which could reduce consumptive water availability in the Goulburn system by up to 30 per cent – see page 24)
- the transfer of water from consumptive use to the environment (in particular, through the Commonwealth's Basin Plan and \$3.1 billion water purchase for the environment – see pages 42 and 45).

“... as water is removed from rural communities, jobs and wealth creation will also disappear and will result in further urban migration. The principle of regional development should be a key priority in the development of the strategy and making response decisions.”

– Draft Strategy submission DS134

A permanent reduction in water availability for irrigation will reduce the area of land that is irrigated, with flow-on effects for communities currently dependent on irrigation industries.

Large amounts of water have been transferred within and between irrigation districts over the past 12 years as the market moves water from lower to higher-value uses. These transfers need to continue in the future. The adjustment resulting from them has been a difficult process for some people, but it is inevitable that this will continue.

In the past, impacts on regional economies have been manageable because water has tended to move from low-value uses that employ relatively few people to higher-value uses that employ relatively more people. For example, water moving from mixed farming to horticulture will generally result in a net increase in economic activity and employment. More recently the opportunities to source water from low-impact areas have diminished; we are now seeing water moving from higher-value, higher-employing industries such as dairy to other higher-employing industries or to the environment.

The Victorian Government has taken action to increase the amount of water available to meet the environmental needs of the River Murray and Snowy River. It has chosen to do this by investing in the modernisation of irrigation infrastructure rather than buying water from productive farms. This approach was adopted because it helps grow regional economies and jobs, unlike the alternative of buying water on the water market.

The adjustment processes of the past 12 years will be accelerated and extended by the Commonwealth's water purchase program and Basin Plan (see page 45).

So how can regional communities be supported through this adjustment? There are many possible approaches (see Figure 9.2) and these can be categorised into water-related and non water-related responses. The water-related responses set out in this Strategy include: increasing production from available water resources; limiting the reduction in the consumptive water pool; and encouraging investment in diverse industries, including those that are not water-dependent. A key constraint on the rate of adjustment has been the four per cent limit on the trade of water shares out of irrigation districts. Recent changes to this limit are outlined on page 108.

Figure 9.2 Many factors in supporting communities through adjustment



Key

- Water related strategies
- Non-water related strategies

9.2.1 Encouraging community development

Non-water related responses to adjustment include policies or programs to manage the socio-economic impacts, such as alternative employment schemes. They may focus on enhancing individual and community capacity and ensuring individuals have access to financial and personal advice. In some cases, unemployment benefits or assistance in seeking alternative employment may be required. Existing programs may be sufficient, however in undertaking its water programs (see page 45), the Commonwealth Government will need to consider the benefits of additional programs. As a partner government in the NWI, the Commonwealth has agreed to address any significant adjustment issues arising from its water reforms.

The Victorian Government is providing direct support to the farming sector through the *Future Farming* strategy, which will deliver targeted services to meet the needs of farm businesses and to match industry needs. \$205 million will be invested over four years to build a strong and secure future for the farming sector by:

- boosting productivity through technology and changes in farming practices
- building skills and attracting young people to farming
- understanding and managing climate change

- strengthening land and water management
- helping farming families to secure their futures
- developing new products and securing new markets
- transporting products to market.

Further information on *Future Farming* and a range of drought support services and programs is available at www.dpi.vic.gov.au.

Broader support to regional communities is being provided by Regional Development Victoria, established to facilitate economic, infrastructure and community development in rural and regional Victoria (see www.business.vic.gov.au). Its focus is on investment attraction, job creation, exports, creating stronger economies, communities and infrastructure to create a strong and growing provincial Victoria. There are several programs to:

- promote business and industry development
- work with local government and communities
- help new businesses establish themselves
- pave the way for existing industries to grow and diversify.

A COAG working group considered the impacts of structural adjustment and assessed the range of strategies designed to manage those impacts. The key findings were:

1. Information provision and communication is key to building community and stakeholder acceptance of change.
2. Adjustment assistance should be time-limited and targeted towards those directly affected by the policy change.
3. Any assistance should be directed towards facilitating adjustment, not supporting unviable enterprises or investments.
4. In situations where the adjustment shock is expected to be significant, phasing the adjustment may reduce the severity of impacts – however, the costs of such delays need to be taken into account.

In advancing this work, a key consideration will be defining ‘those directly affected’. For examples, does it include fruit pickers, other service providers and associated manufacturing and processing industries?

In many cases, adjustment offers new opportunities and encourages innovation in regional communities. CSIRO’s report on water-related adjustments says that “experience suggests that Australian farmers... and rural communities have demonstrated great skill and capacity in adjusting to changing conditions”⁶³. The Victorian Government strongly supports CSIRO’s appraisal. The combination of the strength of regional people and support from government will result in strong, vibrant and resilient regional communities.

Appendix 1: Independent Panel report on public submissions to the Draft Strategy

The Independent Panel

As outlined in Chapter 1, an Independent Panel was formally appointed by the Minister for Water to consider public submissions and other feedback from the consultation program. Panel members and their credentials are listed below. The Panel was nominated on 28 February 2008 under Section 22F(1) of the *Water Act 1989*. Under this legislation, the Panel may include in its report any recommendations at its discretion. The Panel reviewed 135 public submissions to the Discussion Paper, and their final report on the key issues arising from these was submitted to the Minister on 12 May 2008. The Panel reviewed 177 public submissions to the Draft Strategy and submitted their report to the Minister on the 20 February 2009. A copy of these reports and all public submissions are available from www.ourwater.vic.gov.au/programs/sws/northern.

Table A1.1 summarises the recommendations made by the Independent Panel on the Draft Strategy and provides the Victorian Government's response to these recommendations, including cross references to where they are addressed in the Strategy.

Christine Forster (Chair), AM

Mrs Forster became a Member of the Order of Australia in 2006 in recognition of her service to the environment in the area of water resource management, through a range of consultative and advisory roles. She is Acting Chair of the Victorian Water Trust Advisory Council and a member of the Ministerial Reference Council on Climate Change Adaptation and the Future Farming Advisory Panel. She is a Director of VicSuper Pty Ltd, former Chair of the Victorian Catchment Management Council and former Board member of the Cooperative Research Centre for Catchment Hydrology and Land and Water Australia. Mrs Forster has wide-ranging experience on a number of other bodies related to water and irrigation, including Landcare. She is also a wool producer in western Victoria and has been actively involved with rural adjustment and regional development issues.

Professor Peter Cullen (Chair to February, 2008) AO, FTSE

Professor Cullen passed away on 13 March 2008. He was one of Australia's most prominent and respected water experts, using his vast knowledge and passion to persuade governments, scientists, community groups, farmers and students about the importance of sustainable water resource management. His contribution to this country's water management spanned across the states and both sides of the political divide.

Professor Cullen had many strings to his bow, respected by the scientific community as a freshwater ecologist, and looked to as a leader in water resource management and a champion of the environment. For Victoria, Professor Cullen contributed to environmental

and water management for more than 30 years, and was closely involved with developing the Victorian Government's *Our Water Our Future*.

In 2003, Professor Cullen was appointed inaugural Chair of the Victorian Water Trust Advisory Council, established by the Victorian Government to advise on the investment of \$320 million of Trust funds and to provide strategic advice to the government on water issues. Victoria benefited greatly from his expertise in this role, with many significant water projects assessed and recommended for investment.

Professor Cullen chaired the Independent Panel for the *Central Region Sustainable Water Strategy* during 2007. He had agreed to be part of the Independent Panel for the Northern Region Sustainable Water Strategy, which met for the first time in February 2008. Tragically, this role was cut short. His loss is keenly felt.

Professor John Langford, AM

Professor Langford is a Professorial Fellow at the University of Melbourne and Director of the Melbourne Water Research Centre. He is a member of the Victorian Water Trust Advisory Council. Professor Langford has a long history in water resource management and has an impressive list of achievements in the water industry.

Professor Langford was inaugural Executive Director of the Water Services Association of Australia, the peak body of the Australian urban water industry, from 1994 to 2003. He was the Managing Director of the Rural Water Corporation, Victoria's state-wide irrigation and rural water authority, from 1989 to 1994. Professor Langford was the Manager, Water Supply Headwork and Distribution for the Melbourne and Metropolitan Board of Works for 16 years. He is a former Chairman of the Cooperative Research Centre for Catchment Hydrology, the Cooperative Research Centre for Freshwater Ecology and the Murray-Darling Freshwater Research Centre.

Barry Steggall

Mr Steggall is the former State Deputy Leader of the National Party and Member for Swan Hill (1983-2002), and former Shadow Minister for Agriculture, Water Resources and Technology (1999-2000). He was Chair of the Murray Bulk Water Entitlements Committee (1996-1998), Swan Hill City councillor (1973-1983) and Mayor (1980-1982). As a Member of Parliament, Mr Steggall held several important positions, including Secretary of the Liberal/National Coalition (1992-1999), Senior Parliamentary Secretary to the Premier (1992-1996), Parliamentary Secretary to State Development (1996-1999), Convenor of Food Victoria (1993-1999) and Secretary Liberal/National Partnership (1999-2000). Mr Steggall is a member of the Victorian Water Trust Advisory Council and the Northern Victoria Irrigation Renewal Project Board.

Table A1.1 Government response to Draft Strategy Independent Panel report

Independent Panel: key findings and report reference	Government response	Strategy reference
Consultation and submissions		
Every effort has been made to engage people, interest groups and communities that will be affected by the policies, programs and projects proposed by the Strategy (page 5).	No response required.	Chapter 1 (section 1.4)
Objectives of the Strategy		
The final Strategy should be more explicit in articulating a sustainable water strategy for the region in the 50-year timeframe, as required by the Act (page 5).	Agree. The Strategy sets out an action plan to sustainably manage the region's water resources in light of 50-year forecasts.	Chapters 3 to 9
The final Strategy should also identify ways to increase and set priorities for increasing the volume of water in the environmental water reserve... (page 5).	Agree. The Strategy specifically addresses how the northern rivers will be managed into the future including water recovery targets.	Chapter 7 (section 7.1.1)
It is particularly important for the final Strategy to be robust and address the step change (Scenario D) where the dry conditions of the past 12 years will continue (page 5).	Agree. Strategy actions address a range of future water availability scenarios, including Scenario D.	Chapter 2 (section 2.3)
Relationship to the Murray-Darling Basin Authority's Basin Plan		
The Strategy should guide regional approaches on matters such as the review of water-sharing agreements, revising the cap on surface water diversions, setting a cap on groundwater extractions, protecting regional communities when changing water trading rules and purchasing water for the environment, priorities for environmental water recovery and integrating the management of environmental water across the Basin (page 5).	Agree. The Strategy addresses each of these issues.	Chapter 3 (sections 3.2-3.4) and Chapter 7 (section 7.1.1)
There are several issues currently unresolved – for example, 4% trade limit out of a district and 10% limit on the amount of water entitlements not attached to land (page 5).	Noted. The Strategy reflects recent Victorian Government announcements.	Chapter 5 (section 5.3.2)
Regarding the Commonwealth's water purchase program, there must be a transparent review of the implications for the operation of the system on remaining entitlement-holders. The purchase must be targeted (page 5).	Agree. The Strategy outlines recent agreement to a targeted purchase approach.	Chapter 3 (section 3.2.2)
More responsive management of the environmental water reserve		
There is an urgent need for all water processes to be more responsive in both developing and implementing policy change. The regulatory process in the Draft Strategy may not provide the level of responsiveness needed (page 6).	Noted. The Strategy consolidates the range of tools required to manage the needs of the Northern Region's rivers.	Chapter 7 (particularly section 7.1.2 and 7.3.3)
The environmental water manager will require multi-year carryover and should be empowered to trade in environmental allocations (page 6).	Noted. The Strategy provides for more flexible carryover and trade for all entitlement-holders.	Chapter 5 (section 5.2 and 5.3)
The Draft Strategy is silent on the issue of future projections for water prices. The final Strategy should articulate the principles on which future pricing will be based (page 7).	Noted. Price setting in Victoria's water sector is overseen by the ESC (www.esc.vic.gov.au).	Chapter 10 (section 10.1.2)

Draft Strategy proposal		Independent Panel findings	Government response	Strategy Reference
5.1	Objective of the system reserve	Support. The panel also supports the efforts of NVIRP and urban water corporations to reduce the volume of water needed to operate the system.	Noted.	Section 5.1.1 and section 6.1
5.2	Seasonal allocation policy	Support. Needs publicly available set of rules. Believes many submitters misunderstand the concept of a 'system reserve'.	Agree. Additional communication undertaken on the system reserve through Project Update 5 and stakeholder meetings.	Section 5.1.1
5.3	Shortening the irrigation season	Support. Needs to be transparent and consistent.	Agree.	Section 5.1.2
5.4	Final allocation date	Support.	Noted.	Section 5.1.3
5.5	Amending existing carryover rules	Support review and note a promising draft paper on the concept of a spillable water account. Suggest in future there should be consideration of a single high-reliability share only.	Noted. Changes to Victoria's water entitlements may be considered as part of the 15-year resource review in 2019	Section 5.2 Reference guides 1 and 2 (pages 9-12)
5.6	Introducing carryover for groundwater	Support.	Noted	Section 5.2.5
5.7	Expansion of reticulated systems for domestic and stock	Support. Should include metering of domestic and stock water in reticulated systems.	Metering guided by the draft <i>National Framework for Non-Urban Metering</i> (with no mandatory metering of domestic and stock use currently).	Section 8.2.1
5.8	Pioneering approach to environmental management	Suggest reallocation of environmental water for critical use needs to be transparent and a loan. Suggest under Scenario D additional water entitlement for the environment is needed.	This process is directed by strict policies and procedures through qualification of rights (under the <i>Water Act 1989</i>). The Strategy identifies water recovery targets and outlines future opportunities to recover entitlements for the environment.	Reference Guide 2 (pages 11-12, sections 3.3.1) Sections 7.1.1 and 3.2.2
5.9	Victoria's priorities for water recovery	Support. Victorian Government should engage with the Commonwealth in prioritising the water recovery process within the Basin Plan.	Agree. The Strategy outlines the need for ongoing communication between the states and Commonwealth.	Sections 3.2.1, 3.2.2 and 3.4.2
5.10	Changing environmental management objectives	Suggest significant environmental damage could occur before 2019 and that a 5-year review period would be more appropriate.	The Strategy recognises the need for an adaptive approach and reviews of the Strategy (or programs within it) can occur prior to 2019.	Chapter 1 and section 7.3.3
5.11	Managing water quality	Support.	Noted	Section 7.2.1

Draft Strategy proposal	Independent Panel findings	Government response	Strategy Reference
5.12 Water quality standards for environmental watering	Support.	Noted.	Section 7.2.1
5.13 Salinity impact zones	Support.	Noted.	Section 6.3
5.14 Assessing salinity impacts	Support.	Noted.	Section 6.3
6.1 Allowing urban customers access to water markets	Support. Cost effectiveness needs further examination and public discussion is encouraged.	Agree.	Section 8.2.2
6.2 Commonwealth water purchase for the environment	Support. Multiple benefits should be targeted such as retiring unsuitable irrigation land, and co-ordination with modernisation processes.	Agree.	Sections 3.2.2, 6.1.2 and 7.1.1
6.3 Barmah choke trading rules	Support.	Noted.	Section 5.3.3
6.4 Upper limits on trade	Support. Limits should be set solely for the purpose of environmental protection.	All trading rules are set to prevent adverse third party impacts, including on the environment.	Section 5.3.3
6.5 Trading in part- or unregulated systems	Support. Upper catchment irrigators should be able to enter the water market just as downstream entitlement holders.	Agree where there are no adverse third party impacts.	Section 5.3.3
6.6 Leasing options	Support.	Noted.	Section 5.3.3
7.1 Principles for converting savings to entitlements	Support. Subject to rigorous measurement, accounting and auditing.	Agree. <i>Water savings protocol for the qualification of water saving from irrigation modernisation projects</i> developed.	Section 6.1.3
7.2 Roles and responsibilities in water savings projects	The regulatory process outlined in the Draft Strategy may not provide the level of responsiveness needed.	Noted. <i>Water savings protocol for the qualification of water saving from irrigation modernisation project</i> developed and supports the Strategy.	Section 6.1.3
7.3 Maximising the benefits of modernisation	Modernisation needs to improve the service levels for efficient use of water by all users.	Agree.	Section 6.1
	Infrastructure investment is important for maximum environmental benefit.	Agree.	Section 6.1.2
	Catchment management authorities should consult with modernisation projects to coordinate works for multiple benefits.	Agree.	Section 6.1.2
7.4 Urban drought response plans	Support.	Noted.	Section 8.1.1

Draft Strategy proposal		Independent Panel findings	Government response	Strategy Reference
7.5	Revising uniform water restriction schedules	Support. Consistent approach is required for all sources of water.	The Strategy supports restrictions based on the condition of the water resource.	Section 8.3.2
7.6	Permanent water savings rules	Support.	Noted.	Section 8.3.1
7.7	Environmental water holder	Commonwealth and Victorian Environmental Water Holder roles must be consistent and engage to ensure clear responsibilities.	Agree.	Sections 3.4.2 and 7.1.2
		Mechanisms required for the VEWH and the catchment management authorities to engage with community organisations that hold water for environmental purposes.	Noted.	Section 7.1.2
7.8	Structural works and infrastructure upgrades	Support.	Noted.	Section 7.1.2
7.9	Using consumptive water en route	Support. Accounting for increased losses will need to be addressed and clarified.	Agree.	Section 7.1.2
7.10	Reuse of return flows	Support. Measurement needs to be rigorous and transparent.	Agree.	Section 4.7
8.1	The <i>Murray-Darling Basin Agreement</i>	The Strategy may need to be reviewed post Basin Plan.	Agree. It is intended that the Strategy will be reviewed before 2019 to prepare for the implementation of the Basin Plan.	Section 10.2
		Future sharing arrangements must be more robust and be equitable across jurisdictions.	Agree.	Section 3.3
		Clear definitions of concepts such as 'system operating water', 'critical human needs', and 'sustainable diversion limits' are needed.	Agree.	Glossary
8.2	The Murray-Darling Basin Cap - surface water	Support.	Noted.	Section 3.2.1
8.3	The Murray-Darling Basin Cap - groundwater	Suggest the connectivity of groundwater and surface water be addressed and caps may have to be adjusted.	Noted.	Section 3.2.1
8.4	Access to dead storage	Support.	Noted.	Section 4.4.1
8.5	Improving bulk entitlements for unregulated systems	Support. Bulk entitlements should continue to comply with the Murray-Darling Basin Cap.	Agree. Bulk entitlements will continue to comply with the Cap until it is replaced by the limits on diversions in the Basin Plan.	Sections 4.4.2 and 3.2.1
8.6	Refining delivery bulk entitlements	Support. It needs to be clear that this proposal is about delivery share as well as storage share.	Associated text provides clarification.	Section 4.4.1 and Reference Guide 1 (pg9-10)

Draft Strategy proposal	Independent Panel findings	Government response	Strategy Reference
8.7 Quantifying system operating water	Support.	Noted.	Section 4.4.1 (specifically Action 4.15)
8.8 Allocating system operating water in dry years	Guidelines should provide for the clear separation of consumptive, environmental and system operating water.	Where possible, these will be separately quantified. Where this is not possible, it will remain system operating water, which provides benefits for both consumptive users and the environment.	Section 4.4.1
8.9 Properties of environmental entitlements	Support. The environment should have the same entitlement and flexibility as consumptive users	Agree. New environmental entitlements will have the same characteristics as consumptive entitlements, with additional flexibility where possible.	Section 4.5.1
8.10 Creating an environmental entitlement from unregulated flows	Support.	Noted.	Section 4.5.2
8.11 Passing flows for the environment	Support.	Noted.	Section 4.5.2
8.12 Barmah-Millewa Environmental Water Allocation	Support.	Noted.	Section 4.5.2
8.13 Goulburn 80 GL flood release	Support. A legal framework is required to enable delivery of overbank flows.	The risk of flooding private land will be assessed and mitigated.	Section 4.5.2
8.14 Headworks charges for new environmental entitlements	Support. The final Strategy should outline how distribution costs for environmental water will be met.	Noted.	Section 4.6.3
8.15 Delivery of environmental water in river and distribution systems	Support. Final Strategy should outline how distribution costs for environmental water will be met.	Noted.	Section 4.6.3
8.16 Guidelines for determining reasonable domestic and stock use	Support. The final Strategy should identify stressed catchments and establish a working group to trial a regulatory regime.	The Final Strategy provides for improved management of domestic and stock water use.	Section 4.2
	Planning authority may need to reticulate or use rainwater tanks rather than catchment dams.	The Strategy outlines the process to reticulate domestic and stock water supplies.	Section 8.2.1
8.17 Licensing arrangements for dairy use	Support.	Noted.	Section 4.3.4

Draft Strategy proposal	Independent Panel findings	Government response	Strategy Reference
8.18 Managing sleeper licences	<p>Recommends that the government identify and quantify sleeper licences, review at end of current licence period and not renew unused licences.</p> <p>Changes to sleeper licence conditions would only take place through the development of local management rules.</p>	<p>Currently, the rights of all licence holders are recognised. Work is ongoing to quantify sleeper licences for priority unregulated rivers (www.ourwater.vic.gov.au).</p> <p>Local management rules will not prevent the activation of sleeper licences but outline arrangements governing all licensed use. Changes to licence conditions occur through management plans or upon renewal.</p>	Section 4.3.4
8.19 Converting Section 51 licences to water shares	Support.	Noted.	Section 4.3.4
8.20 Revising groundwater PCVs to account for the expansion of Victoria's licensing regime	Support.	Noted.	Section 4.3.2
8.21 PCVs for unincorporated groundwater areas	Support.	Noted.	Section 4.3.2
8.22 Regional guidelines for licensing of unregulated supplies	Support.	Noted.	Section 4.3.1
8.23 Local management rules	Support.	Noted.	Section 4.3.1
8.24 Groundwater restrictions	Support.	Noted.	Section 4.3.3
8.25 Streamflow management plans	Support.	Noted.	Section 4.3.1
8.26 Groundwater/surface water interactions	Support. This should be given high priority.	Agree. The upper Ovens integrated management plan will guide future management of such highly connected systems.	Section 4.3.1
8.27 Pricing in unregulated systems	Support.	Noted.	Section 10.1.2

Appendix 2: Average availability of surface and groundwater

The following tables outline the average availability of surface water under historical inflows (Table A2.1) and under a continuation of recent low inflows (Table A2.2).

Table A2.3 outlines the current use and available water in the Northern Region's major groundwater systems.

Table A2.1 Average surface water availability in the Northern Region based on historic inflows (GL/year)

System	Total resource	Water that can be taken under entitlements					Average environmental water	Distribution losses
		A	B	C	D	E	F	G
		Average annual streamflows	Regulated rivers Urban use	Rural and domestic and stock	Unregulated rivers	Unlicensed dams	Total	Average flows at basin outlets
Murray	7,618	58	1,549	21	8	1,636	4,089 ***	395
Kiewa	689	1	0	14	5	21	674	n/a
Ovens	1,758	11	26	20	20	78	1,695	n/a
Broken	308	2	37	6	23	68	184	n/a
Goulburn	3,363 **	44	1,788	29	58	1,919	1,591	475
Campaspe	352	47	72	5	44	166	162	n/a
Loddon	373	2	102	23	80	207	109	n/a
Total	10,230 **	165	3,575	119	237	4,095	4,089 ***	870

A Except for Kiewa Basin, estimates from long-term inputs to resource allocation models of basins plus estimates of usage from unregulated rivers and small dams (2004/05 use from *State Water Report 2004-05*). For Kiewa Basin, mean annual basin outflows estimated from input to Murray Basin resource allocation model plus estimates of urban use and usage from unregulated rivers and small catchment dams (2004/05 use from *State Water Report 2004/05*).

****** End of valley flows from upstream Basins excluded to avoid double counting.

B Urban bulk entitlement volumes (not updated from Discussion Paper).

C Estimates as bulk entitlement volumes for rural and domestic and stock use from regulated rivers except for Murray, Goulburn and Campaspe (not updated from Discussion Paper). For Murray, estimated to be equal to Murray/Kiewa/Ovens valley long-term average Cap minus limits on urban (B), rural/domestic and stock (C) and unregulated diversions (D) for Kiewa and Ovens, minus limits on urban (B) and unregulated diversions (D) for Murray. For Goulburn, estimated to be equal to Goulburn/Broken/Loddon valley long-term average Cap minus limits on urban (B), rural/domestic and stock (C) and unregulated diversions (D) for Broken and Loddon minus limits on urban (B) and unregulated diversions (D) for Goulburn. For Campaspe,

estimated to be equal to Campaspe valley long-term average Cap minus limits on urban (B) and unregulated diversions (D) for Campaspe. Long-term average Caps estimated from modelling over long period of historical climate data at 1993/94 level of development.

D Average bulk entitlement volume for licensed diversions on unregulated rivers (from *State Water Report 2005-06*).

E Estimated to be equal to usage in 2005/06 (from *State Water Report 2005/06*).

G Average environmental water estimated as end of valley flows.

******* Estimated as River Murray flow at South Australian border.

Table A2.2 Average availability surface water in the Northern Region under a continuation of low inflows (GL/year)

System	Total resource	Water that can be taken under entitlements					Average environmental water	Distribution losses			
		A	B	C	D	E			F	G	H
		Average annual streamflows	Regulated rivers		Unregulated rivers	Unlicensed dams			Total	Average flows at basin outlets	
			Urban use	Rural and domestic and stock							
Murray	4,430	58	1,341	21	8	1,428	2,005 ***	395			
Kiewa	541	1	0	14	5	21	526	n/a			
Ovens	1,411	11	25	20	20	77	1,143	n/a			
Broken	166	2	19	6	23	50	55	n/a			
Goulburn	1,780 **	44	1,186	29	58	1,317	489	475			
Campaspe	139	47	23	5	44	103	23	n/a			
Loddon	172	2	12	23	80	117	17	n/a			
Total	6,441 **	165	2,606	119	237	3,113	2,005 ***	870			

A Except for Kiewa Basin, estimates from long-term inputs to resource allocation models of basins plus estimates of usage from unregulated rivers and small dams (2005/06 use from *State Water Report 2005-06*). For Kiewa Basin, mean annual basin outflows estimated from input to Murray Basin resource allocation model factored down by ratio of Basin outlet (Column G) flows under Scenario D and historical plus estimates of urban use and usage from unregulated rivers and small catchment dams (= 2005/06 use from *State Water Report 2005-06*).

****** End of valley flows from upstream basin/s excluded to avoid double counting.

B Urban bulk entitlement volumes (not updated from Discussion Paper).

C Estimated as long-term average Cap under 'low inflows' minus limits on urban (B) and unregulated diversions (D) except for Ovens. For Ovens, Bulk entitlement volume factored down by ratio of modelled average use under 'low inflows' to under historical inflows. Long-term average Caps estimated from modelling over long period of 'low inflows' and demands at 1993/94 level of development.

D Bulk entitlement volumes for licensed diversions on unregulated rivers (from *State Water Report 2005-06*).

E Estimated to be equal to usage in 2005/06 (from *State Water Report 2005/06*).

G Average environmental water estimated as end of valley flows.

******* Estimated as River Murray flow at South Australian border.

H Volumes also included in B and C (not updated from Discussion Paper).

Table A2.3 Groundwater availability in the Northern Region

Groundwater management unit	Licensed entitlements (GL)	Volume used in 2005/06 (GL)		Total use (GL)
		Licensed use*	Unlicensed use (domestic and stock)^	
Campaspe deep lead WSPA	46.3	34.8	0.2	34.9
Shepparton WSPA	232.2	109.2	0.2	111.7
Spring Hill WSPA	5.1	2.5	0.1	2.6
Katunga WSPA	59.7	30.8	0.5	31.3
Mid Loddon WSPA	37.2	22.9	0.2	23.1
Upper Loddon WSPA	13.4	6.2	0.3	6.5
Alexandra GMA	1.7	1.0	0.02	1.0
Barnawartha GMA	2.1	0.3	0.02	0.3
Ellesmere GMA	2.3	1.4	0.03	1.4
Goorambat GMA	4.9	0.9	0.01	0.9
Kialla GMA	2.3	1.4	0.01	1.4
Kinglake GMA	2.0	1.2		1.3
Mullindolingong GMA	7.0	0.8	0.05	0.8
Murmungee GMA	16.7	7.1	0.34	7.4
Nagambie GMA	6.6	5.0	0.09	5.0
Unincorporated areas	46.2	16.2	6.5	22.6
Total	485.7	241.6	10.9	252.5

* Includes metered and estimated unmetered use.

^ Estimated assuming 2 ML/bore per annum.

Appendix 3: Factors influencing Victoria's climate

Key influences on Victoria's climate

The major influences on Australia's climate are shown in Figure A3.1. These influences have varying levels of impact in different regions at different times of the year. Details of the various influences, including the spatial extent and timing of their impacts can be found on the Bureau of Meteorology's website. The descriptions of the sub-tropical ridge and the Southern Annular Mode (SAM) below are largely taken from this source.

Of these influences, those most important for Victoria's climate are highlighted by red text in Figure A3.1. Larger-scale influences also known to have an impact but not shown, include global warming of the atmosphere and oceans due to the enhanced greenhouse effect, ozone depletion over the Antarctic, and the impact of Northern Hemisphere aerosol pollution (via impacts transmitted southwards through the Indian Ocean). Ocean currents are also important influences – both the surface currents within and linking the major ocean basins and the deeper ocean currents that form the 'global conveyor belt' linking the Pacific, Indian, Atlantic and Southern oceans.

Changes in rainfall patterns over south-east Australia in the past decade have been linked primarily to increases in mean sea level pressure over southern Australia which, in turn, are linked to increasing intensity of the **sub-tropical ridge**^{64,65}. This is a belt of high pressure between 30-35° south (and north). It is part of the global circulation of the atmosphere (see Figure A3.2). The position of this ridge has a seasonal cycle, being furthest north in early spring and furthest south in late summer (and the position of the mid-latitude westerlies to the south of the ridge also reflect this seasonal cycle). During the warmer half of the year (November to April), the sub-tropical ridge is generally located to the south of Australia. In autumn, the sub-tropical ridge moves northwards and remains over the continent for most of the colder half of the year (May to October). High pressure systems, which are associated with stable and dry conditions, move eastwards along the ridge. As well as changes in the intensity of the ridge over the past decade, there have been changes in its seasonal cycle, as it has been moving northwards later in autumn^{66,67,68}.

2. The changes in mean sea level pressure also reflect an increasing trend in the **SAM**. The SAM is a relatively short-term mode of climate variability (10+ days) characterised by a 'flip-flopping' of pressures and associated changes in storms and windiness between mid (~45°S) and higher ~ (65°S) latitudes. During a 'positive' SAM event, the belt of strong westerly winds contracts towards the South Pole. This results in weaker than normal westerly winds and higher pressure (and more stable conditions) over southern Australia. Conversely, a 'negative' SAM event reflects an equator ward expansion of the belt of strong westerly winds, resulting in more storm systems and lower pressures over southern Australia. While there has been a generally increasing trend in 'positive' SAM over recent decades, the magnitude of the trend varies between seasons as does the strength and direction of the association between SAM and Victorian rainfall, and it does not appear to account for the changes in autumn rainfall⁶⁹. The influence of the SAM is still an active area of research.

Overall, the changes in these influencing factors over the past decade mean that:

- a) Victoria has been less exposed to the influence of the mid-latitude westerlies and the associated embedded frontal systems and low pressure systems that typically bring regular rainfall.
- b) There has also been a decrease in the amount of rainfall associated with cut-off lows (low pressure systems that break off from the main belt of low pressure to the south of Australia) which are important in creating an effective 'autumn break' and in providing growing season rainfall.

Figure A3.1 Australian climate influences⁶⁹

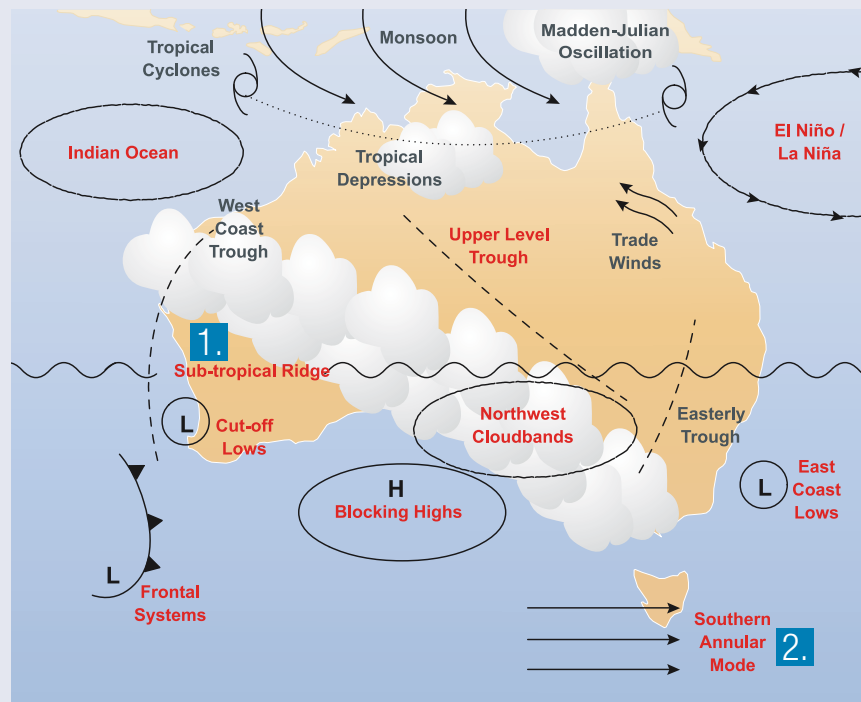
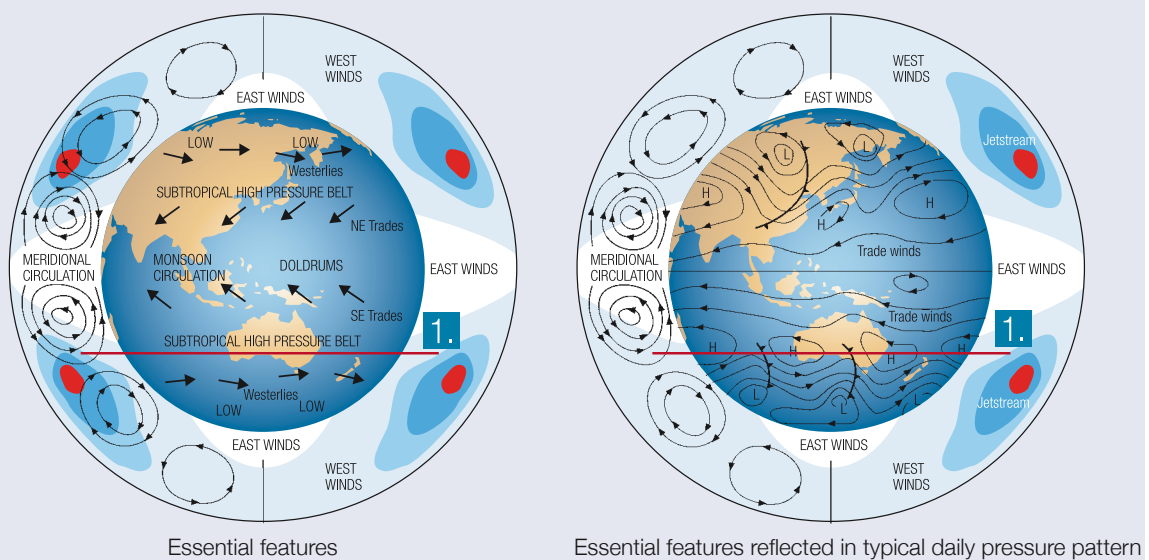


Figure A3.2 Essential features of the general circulation of the atmosphere^{70,71}



Appendix 4: Existing environmental entitlements

Table A4.1 outlines the current range of environmental entitlements (including rules-based entitlements) available for the major river systems of northern Victoria, based on historical inflows.

It includes Victoria's entitlements to date under the Living Murray Initiative but not the Snowy Water Recovery Project.

Table A4.1 Existing environmental entitlements in the Northern Region

River system	High-reliability entitlement (GL)	Low-reliability entitlement (GL)	Rules-based environmental water (GL)*	Average availability (GL/year)	Comment
Murray		99		37.0	Murray Environmental Entitlement (from Living Murray conversion of sales water)
	27.6			27.5	Flora and Fauna Bulk Entitlement
			50	49.8	Barmah Environmental Water Allocations
			25	19.0	
Goulburn			80	11.9	Goulburn Murray Bulk Entitlement (flood release)
		141		80.1	Goulburn Environmental Entitlement^ - Living Murray
Campaspe		5		3.8	Campaspe environmental entitlement^ (from Living Murray conversion of sales water)
Loddon		2		1.1	Loddon bulk entitlement (from Living Murray conversion of sales water)
	2			1.9	Loddon Bulk Entitlement (for Boort wetlands)
Total				232.1#	

Notes:

* 'Rules-based environmental water' column relates to water that may be actively used for environmental purposes, but are not environmental entitlements. In these cases, water is re-regulated to meet consumptive requirements.

^ 'Sales water in the Goulburn and Campaspe Rivers is designated for the Living Murray, and is likely to be called out in winter-spring to meet icon site demands. They cannot be called out to meet tributary requirements alone (eg. summer low flows for drought refuge may not be met with the use of this water).

Average environmental water availability equates to approximately 6% of total average environmental flows as measured at Basin outlets (refer Appendix 3 on availability of surface water in the Northern Region).

Appendix 5: Government's response to calls to build new dams

New dams

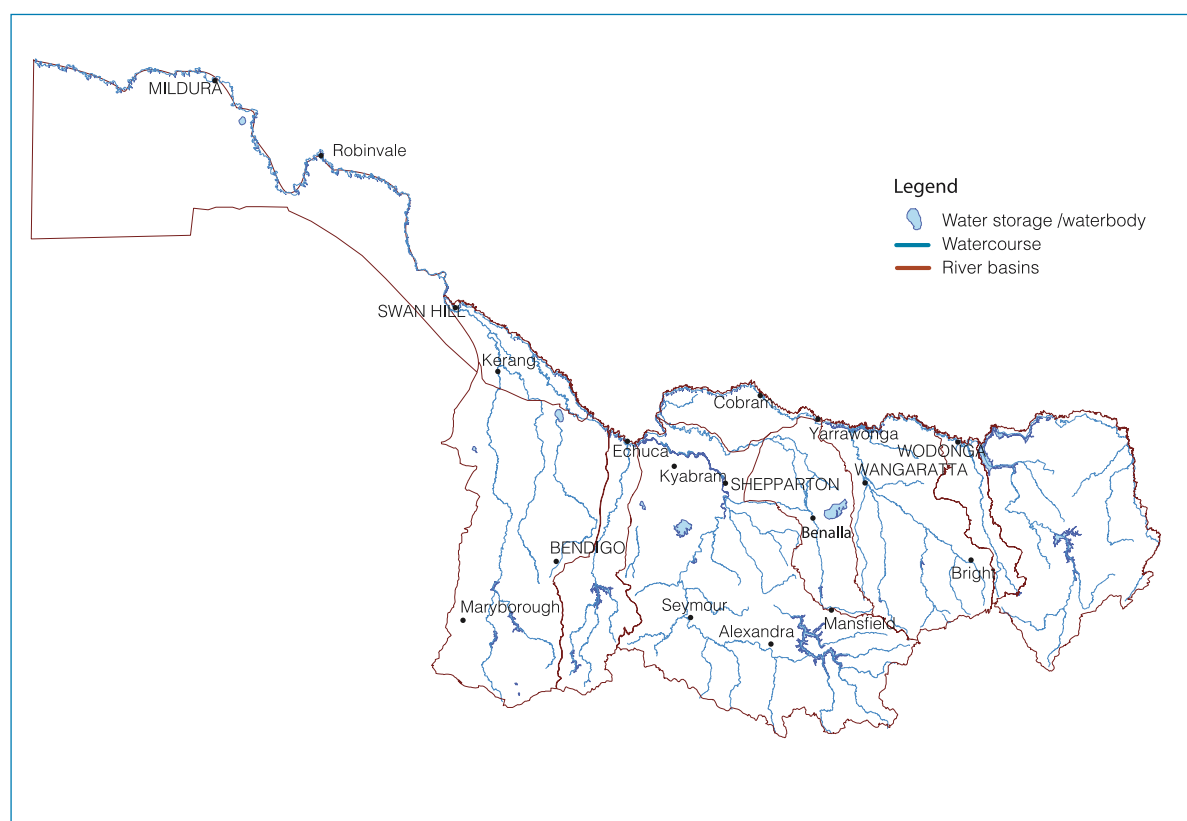
Many large dams have been built in Victoria over the past 150 years to supply water for towns, industry and irrigation. Some 21 storages of 10 GL or more have been built in the Northern Region, totalling more than 12,000 GL of storage capacity (see Figure A5.1). These storages have (and continue to) support current levels of water use. The State Government acknowledges that some members of the community have suggested that new dams should be built in northern Victoria. With the Murray-Darling Basin Cap in place (see page 11), Victoria is not permitted to divert more water, even if new storages are built.

The past 12 years of drought have seen the levels of the region's reservoirs drop. In light of the potential impacts of climate change, this suggests there is sufficient capacity in the region to store the available inflows. New dams are not the solution to reduced water availability, especially in times of low rainfall.

The State Government does not support the construction of new on-stream storages for the following reasons:

- New dams do not create new water. They take water from rivers and downstream irrigators.
- The amount of water that can be diverted from the region's rivers (to be stored in reservoirs) is determined by the Murray-Darling Basin Cap. Under this Cap, any increased consumptive harvesting associated with upgraded or new dams would need to be offset through equivalent reductions in other parts of the Basin. New or enlarged dams would capture flows that would otherwise have been captured further downstream or used to fulfil Victoria's commitment to provide flows to South Australia.
- It would take large investments to create new dams – someone would need to pay for the construction and maintenance. The most cost-effective and reliable storages have already been built.
- New dams would seriously impact on the health of rivers and wetlands, many of which are already stressed.
- Expanding the water grid (interconnecting supply systems) reduces the need for increased storage capacity, by improving the movement of water to where and when it is needed.

Figure A5.1 Major storages in the Northern Region (GL)



Summary of hydrological impacts of enlarging Buffalo Dam

The previous section highlighted the reasons the government does not support the construction of new on-stream storages. Many of these reasons also apply to the expansion of existing storages. There has been some previous discussion, highlighted through the stakeholder engagement and submissions process for the Discussion Paper, of the option to expand Lake Buffalo, near Myrtleford.

“...Government should reconsider its decision on more dams. We support the construction of Stage 2 Buffalo Dam and William Hovell Dam. This extra storage would store water in the event of a severe rain event and enable it to be used to cover existing allocations in dry periods.”

- Discussion Paper submission (DP013)

Analysis was undertaken to determine the potential hydrological benefits and impacts of expanding Lake Buffalo to a storage capacity of 1,000 GL under the following water availability scenarios⁶²:

- base case (long-term average, based on the historic inflows)
- Scenario B (medium climate change)
- Scenario D (continuation of recent low inflows).

A series of model runs made different assumptions about the purpose of the additional storage capacity and compliance with the Murray-Darling Basin Cap:

1. Additional storage capacity used to supply new entitlement in the Ovens system, assuming compliance with the Murray-Darling Basin Cap.
2. Additional storage capacity used to supply new entitlement in the Ovens system, assuming no compliance with the Murray-Darling Basin Cap.
3. Additional storage capacity used to supplement supply for existing entitlements in the Murray system, assuming compliance with the Murray-Darling Basin Cap.
4. Additional storage capacity used to supplement supply for existing entitlements in the Murray system, assuming non compliance with the Murray-Darling Basin Cap.

Essentially, if the additional storage capacity was allowed to result in a breach of Victoria's share of the Murray-Darling Basin Cap (model runs 2 and 4), this would result in reduced supply to New South Wales and South Australia (up to 105 GL and 400 GL respectively). In addition, it would have significant environmental impacts. For example, the number of years that the Barmah Forest was flooded could be halved (under model run 2 and a continuation of recent low inflows). Water availability for the environment could also be significantly reduced in the Ovens River. Victoria is committed to complying with the Cap under the *Murray-Darling Basin Agreement* and new *Agreement on Murray-Darling Basin Reform*.

In addition, these hydrological results demonstrate there would be unacceptable impacts to New South Wales, South Australia and the environment if Victoria did not comply with the Cap as a result of enlarging Lake Buffalo.

If the additional storage capacity was used to supply new entitlements in the Ovens system (model runs 1 and 2), this would be at the expense of existing entitlement-holders in the Murray system. In short, water availability for Murray water users could be reduced by up to 175 GL a year. Under the more severe climate change scenario, the number of years with full allocations could be reduced from 68 per cent to 52 per cent. Again, this is clearly an unacceptable impact.

The only remaining option is to use the additional storage capacity to supplement existing Murray entitlements, ensuring compliance with the Cap (model run 3). This would increase water availability for Murray water users by a maximum of 7 GL a year. This is a relatively limited benefit, given the significant economic cost of enlarging the dam. This is particularly true when the environmental impacts are considered.

The same types of impacts would occur if new dams were built elsewhere in the north-east or if existing dams, such as Lake William Hovell, were expanded. Because Victoria must remain compliant with the Cap, enlarging these dams provides limited benefit to water users. As such, the government does not support enlarging Lake Buffalo or Lake William Hovell.

The complete report is presented as Background Report 9 available at www.ourwater.vic.gov.au/programs/sws/northern.

Additional storage capacity used to supply new entitlement in the Ovens system:

- 1) Assuming compliance with the Murray-Darling Basin Cap an enlarged Buffalo Dam would result in:
 - reduced water availability for Victorian Murray water users under all scenarios (reduction of up to 175 GL/year under the base case scenario)
 - reduced reliability for Murray high-reliability water shares under all scenarios (reduced from 89 to 77 years out of 100 with full allocations under Scenario B)
 - reduced reliability for Murray low-reliability water shares under all scenarios (average allocation reduced from 62 to one per cent under base case scenario)

- reduced water availability for New South Wales water users under all scenarios (reduction of up to 78 GL/year under Scenario B)
- reduced water availability for South Australia under all scenarios (reduction of up to 275 GL/year under the base case scenario)
- reduced flooding at Living Murray icon sites under all scenarios (number of years with floods at Barmah Forest reduced from 33 to 26 out of 100 under the base case scenario)
- additional water required to meet environmental flow recommendations in the Ovens River under all scenarios (an additional 330 GL/year under Scenario B).

Additional storage capacity used to supply new entitlement in the Ovens system:

2) Assuming no compliance with the Murray-Darling Basin Cap an enlarged Buffalo Dam would result in:

- reduced water availability for Victorian Murray water users under all scenarios (reduction of up to 131 GL/year under Scenario D)
- reduced reliability for Murray high-reliability water shares under all scenarios (reduced from 68 to 62 years out of 100 under Scenario D)
- slight increase in reliability for Murray low-reliability water shares under most scenarios (average allocation increased from 62 to 68 per cent under base case)
- reduced water availability for New South Wales water users under all scenarios (reduction of up to 105 GL/year under Scenario B)
- reduced water availability for South Australia under all scenarios (reduction of up to 400 GL/year under the base case scenario)
- reduced flooding at Living Murray icon sites under all scenarios (number of years with floods at Barmah Forest reduced from 15 to 8 years out of 100 under Scenario D)
- additional water required to meet environmental flow recommendations in the Ovens River under all scenarios (an additional 330 GL/year under Scenario B).

Additional storage capacity used to supplement supply for existing entitlements in the Murray system:

3) Assuming compliance with the Murray-Darling Basin Cap:

- slight increase in water availability for Victorian Murray water users under all scenarios (an increase of up to 7 GL/year under Scenarios B and D)

- slight increase in reliability for Murray high-reliability water shares under all scenarios
- reduced reliability for Murray low-reliability water shares under all scenarios (average allocation reduced from 20 to 10 per cent under Scenario D)
- slight increase in water availability for New South Wales water users under all scenarios (an increase of up to 24 GL/year under Scenario D)
- slight decrease in water availability for South Australia under most scenarios (reduction of up to 24 GL/year under Scenario D)
- little impact on flooding at Living Murray icon sites under all scenarios (number of years with flooding at Barmah Forest)
- additional water required to meet environmental flow recommendations in the Ovens River under all scenarios (an additional 240 GL/year under Scenario D).

Additional storage capacity used to supplement supply for existing entitlements in the Murray system:

4) Assuming no compliance with the Murray-Darling Basin Cap an enlarged Buffalo Dam would result in:

- slight increase in water availability for Victorian Murray water users under all scenarios (an increase of up to 55 GL/year under Scenario B)
- slight increase in reliability for Murray high-reliability water shares under all scenarios (increased from 68 to 74 years out 100 under Scenario D)
- increased reliability for Murray low-reliability water shares under all scenarios (average allocation increased from 62 to 83 per cent under base case scenario)
- potential increase in water availability for New South Wales water users under Scenario D (of 18 GL/year)
- reduced water availability for South Australia under all scenarios (reduction of up to 59 GL/year under Scenario D)
- little impact on flooding at Living Murray icon sites under all scenarios
- additional water required to meet environmental flow recommendations in the Ovens River under all scenarios (an additional 256 GL/year under Scenario D).

Table A5.1 outlines the impact on supplies to existing water users under the range of climate change scenarios and under the range of options (1-4) previously outlined.

Table A5.1 Summary of key results of the hydrological impacts of enlarging Buffalo Dam

	Change in average from current						
	Victorian Murray supply						New South Wales supply
Climate scenarios	Model run	New Ovens supply (GL/year)	Victorian Murray supplement (GL/year)	Victorian Murray diversion (GL/year)	Percentage of years with 100% HRWS	Average LRWS allocation (%)	NSW Murray diversion (GL/year)
Base case – long-term average	Current			1714	98	62	1838
	1	666		-175 ¹	-2	-61	-71
	2	666		-16	-5	6	-99
	3		93	1	2	0	5
	4		104	44	2	21	-2
Scenario B – medium climate change	Current			1589	89	38	1515
	1	530		-172 ²	-12	-37	-78
	2	530		-99	-15	2	-105
	3		93	7	6	-5	5
	4		104	55	5	14	0
Scenario D – continuation of recent low inflows (1997/98-2006/07)	Current			1456	68	20	1306
	1	483		-161 ³	-10	-19	-61
	2	483		-131	-16	-1	-61
	3		324	7	6	-10	24
	4		345	78	6	12	18

Notes:

Current – No enlargement of Buffalo Dam for three climatic scenarios

Model run 1 - Enlarged Buffalo Dam storage size is 1,000 GL for New Ovens River entitlement within Victorian Murray Cap for three climatic scenarios.

Model run 2 - Enlarged Buffalo Dam storage size is 1,000 GL for New Ovens River entitlement outside Victorian Murray Cap for three climatic scenarios.

Model run 3 - Enlarged Buffalo Dam storage size is 1,000 GL for Ovens regulated supplement to meet the current Murray System commitments within Victorian Murray Cap for three climatic scenarios.

Model run 4 - Enlarged Buffalo Dam storage size is 1,000 GL for Ovens regulated supplement to meet the current Murray System commitments Outside Victorian Murray Cap for three climatic scenarios.

Modifications to the Ovens River basin environmental flow requirements to account for enlarging Buffalo Dam were not considered. It is likely that modifications to the requirements would reduce negative environmental flow impacts, however there would be a consequent decrease in water availability from Buffalo Dam for consumptive use.

¹ In addition to this reduction, a Cap overrun of 460 GL/year occurred.

² In addition to this reduction, a Cap overrun of 344 GL/year occurred.

³ In addition to this reduction, a Cap overrun of 313 GL/year occurred.

Change in average from current								
South Australia supply		Murray icon sites - Years with floods of				Additional water required to meet environmental objectives in Ovens River		
	SA border flow (GL/year)	18,000 ML/d Barmah-Millewa Forest	25,000 ML/d Gunbower wetlands	35,000 ML/d Hattah Lakes	35,000 ML/d Lindsay-Walpolla wetlands	Lake Buffalo to Ovens River (GL/year)	Ovens River below Buffalo River to King River (GL/year)	Ovens River from King to River Murray (GL/year)
	6776	33	37	46	45	4.2	0.5	6.6
	-275	-7	-4	-2	-3	178.5	0.2	122.7
	-400	-6	-5	-5	-5	178.5	0.2	122.7
	1	-1	0	0	0	19.2	-0.3	21.2
	-37	3	0	-1	0	21.3	-0.2	24.6
	4790	22	16	26	27	21.5	1.2	33.0
	-173	-4	-4	-4	-2	164.9	0.4	164.6
	-223	-4	-4	-4	-1	164.9	0.4	164.6
	-5	-2	-2	1	0	56.6	-0.1	102.7
	-49	-3	-3	-1	-1	58.8	-0.1	107.1
	3362	15	6	8	7	40.9	1.5	51.3
	-164	-5	0	-2	-2	148.7	0.1	179.2
	-197	-7	-1	-2	-3	148.7	0.1	179.2
	-23	0	0	-1	-1	76.4	-0.2	163.0
	-59	0	0	-1	-1	83.8	-0.2	172.4

Appendix 6: Developing recovery targets for wetlands

The need for water recovery will be assessed in 30 wetland systems containing 434 high-value wetlands (see Table A6.1).

The process for developing water recovery targets is summarised on page 135. More specific details for each category of wetland are outlined in the following sections, including for:

- River Murray floodplain wetlands
- Victoria's tributary floodplain wetlands
- wetlands associated with irrigation distribution systems.

Floodplain wetlands (River Murray and Victorian tributaries)

These wetlands can be further separated into those identified as 'icon sites' through the Living Murray First Step and those currently outside of the Living Murray process. Given the interstate management arrangements of the Living Murray, and the significant resources already committed to icon sites, this Strategy focuses on the many other high-value floodplain areas.

Providing water to icon sites is likely to provide some benefits to other floodplains wetlands on the Murray due to increased in-river flows, but will not provide overbank flows to the areas that depend on them. For all sites, structural works, such as pumps or weirs, may be the only option to maintain floodplain communities under climate change, in the absence of natural overbank floods.

There has been some public feedback about the need to look beyond 'icon sites' – this was particularly strong from Traditional Owner groups. A project is underway to determine the water requirements of the 'non-icon' river red gum communities along the River Murray floodplain and the feasibility of delivering water to these areas under climate change. It will identify priority areas for watering, methods for water delivery and potential volumes and costs for a program of complementary structural works to deliver environmental water. It will also assess the potential benefits to these sites of Living Murray water. The watering requirements of these sites have already been identified (see Background Report 8). A target for water recovery and a structural works program will be developed following the completion of Living Murray modelling.

Once this process has been completed for River Murray floodplain sites, it will be applied to the wetland systems on Victoria's tributaries (see Table A6.1).

Table A6.1 Wetland systems in the Northern Region (and responsible catchment management authority)

North East CMA	North Central CMA	Goulbourn Broken CMA	Mallee CMA
Lower Ovens	Bendigo Creek	Broken Boosey Nine Mile Creek	Cardross
Murray above Hume	Boort - Loddon flood	Honey Suckle Creek Catchment	Kings Billabong Wetlands
Murray Hume-Yarrawonga	Kerang - Loddon flood	Lower Goulburn	Lindsay River
Mid Ovens	Torrumbarry - Gunbower Creek - operational	Major Plains	Murray Nyah - Murrumbidgee
	Torrumbarry - non operational	Mid Goulburn	Murray Euston-Mildura
	Torrumbarry - operational	Mosquito Depression	Murray below Nyah
	Woorinen	Muckatah Depression	Murray downstream Lock 9
		Murray Yarrawonga - Torrumbarry	Murray Mildura - Lock 10
		Upper Muckatah	Murray Murrumbidgee - Euston
		Waranga/Corop	

Wetlands associated with irrigation distribution systems

Many wetlands in northern Victoria are used to store or convey irrigation water, or have been isolated so they can only receive environmental water via the irrigation distribution system.

An initial assessment of their water requirements found that water requirements can be adequately met under the base case, and an average of an additional 10 GL per year would be required to meet Category 4 requirements under Scenario D. However, this assessment did not consider volumes that may be required to meet Category 2 requirements under Scenario D to manage salinity levels or the impacts of future changes to irrigation systems (eg. reconfiguration and changed operation to minimise losses).

Further work is underway to determine the additional volumes that may be required to meet water requirements for these wetlands, including:

- 1) Undertaking hydrological modelling to assess the adequacy of existing environmental entitlements in meeting minimum flow requirements under Scenario D.
- 2) Improving understanding of how the irrigation distribution system will operate in low allocation years. This affects our ability to deliver environmental water and can result in additional requirements for environmental water to operate the system.
- 3) Assessing requirements for additional water to flush accumulated salts (as a replacement for overland flooding, which is no longer feasible).
- 4) Progressively develop water recovery targets (if required).

Wetlands where recovery targets will not be developed

Water recovery targets will not be developed for the following systems:

- the Living Murray 'icon sites' (see page 136)
- groundwater-fed wetlands (see page 136)
- wetlands where it is not possible to manage flow regimes
- wetlands used for wastewater/sewage treatment plants.

Appendix 7: Water ‘surplus’ or ‘deficit’ for urban communities

Table A7.1 shows how urban systems could be impacted by climate change under Scenario B (medium climate change) and Scenario D (a continuation of recent low inflows), and how much water will be provided by urban water supply demand strategy actions to address supply shortfalls.

Deficits are highlighted in red or orange. They indicate that from this particular year in the given system and scenario, a higher frequency of water restrictions or a higher level of water restrictions will be necessary to ensure security of supply, even if water supply/demand actions are implemented. It does not indicate that a system will run out of water.

Since the release of the Discussion Paper, a range of actions are being implemented by urban water corporations to address urban water shortfalls. These are captured within this updated table.

Table A7.1 - Water surplus or deficit for urban systems and major actions being undertaken by water corporations (Scenarios B and D)

Year	Surplus or deficit in water availability (ML) under Scenario B – medium climate change (assumes implementation of WSDS actions)	Surplus or deficit in water availability (GL) under Scenario D – continuation of low inflows of the past 10 years (assumes implementation of WSDS actions)	Water provided by WSDS actions (ML)	Major action being taken to meet supply deficit
North East Water				
Murray River urban supply system – includes Bellbridge, Corryong, Tallangatta, Wahgunyah, Walwa, Wodonga and Yarrawonga				
Average yield: 11,898 ML/year		Unrestricted annual demand:10,622 ML/year		
2006	-40	-4,721	0	Pipeline from Barnawartha to Chiltern. Purchase of water entitlements on the market.
2015	1,841	-3,081	3,291	
2030	1,327	-3,056	6,369	
2055	339	-2,830	9,293	
Ovens/King River urban supply system* – includes Bundalong, Glenrowan, Moyhu, Oxley, Springhurst, Wangaratta and Whitfield				
Average yield: 7,022 ML/year		Unrestricted annual demand: 5,198 ML/year		
2006	-14	-69	11	Pipeline from Wangaratta to Glenrowan. Purchase of water entitlements on the market.
2015	1,152	1,002	1,196	
2030	1,526	934	1,609	
2055	811	672	1,716	
Upper Ovens River urban supply system – includes Bright, Harrierville and Myrtleford				
Average yield: 1,864 ML/year		Unrestricted annual demand: 1,876 ML/year		
2006	-177	-555	0	Construction of Bright/ Porepunkah off-stream storage.
2015	723	313	1,080	
2030	416	61	1,201	
2055	3	-111	1,342	
Broken River urban supply system – includes Benalla				
Average yield: 1,731 ML/year		Unrestricted demand: 1,817 ML/year		
2006	-124	-915	0	Diversion from Broken River, purchase of water entitlements on the market.
2015	1,309	569	1,794	
2030	695	96	1,879	
2055	49	-263	2,000	

* Figures not available for upper Murray, Kiewa and Dartmouth urban supply systems.

Year	Surplus or deficit in water availability (ML) under Scenario B – medium climate change (assumes implementation of WSDS actions)	Surplus or deficit in water availability (ML) under Scenario D – continuation of low inflows of the past 10 years (assumes implementation of WSDS actions)	Water provided by WSDS actions (ML)	Major action being taken to meet supply deficit
Central Highlands Water				
Maryborough urban supply system – including Adelaide Lead, Bet Bet, Carisbrook, Havelock, Talbot, and surrounding communities				
Average yield: 1,880 ML/year		Unrestricted demand: 2,190 ML/year		
2006	-10	900	300	Commission a new groundwater supply, purchase of additional water entitlements on the market, and use of fit-for-purpose recycled water.
2015	1,370	550	1,630	
2030	1,290	630	1,680	
2055	1,020	690	1,690	
Daylesford urban supply system – including Hepburn Springs, Musk, Sailors Hill and Shepherds Flat				
Average yield: 750 ML/year		Unrestricted demand: 810 ML/year		
2006	-60	-280	0	Use of groundwater supply following licence approval.
2015	280	90	370	
2030	480	350	670	
2055	320	320	670	
Clunes urban supply system – including some outlying properties				
Average yield: 350 ML/year		Unrestricted demand: 280 ML/year		
2006	70	-40	0	Purchase of additional groundwater licence volume.
2015	190	90	120	
2030	140	80	120	
2055	40	404	120	
Waubra urban supply system – including some outlying properties				
Average yield: 100 ML/year		Unrestricted demand: 41 ML/year		
2006	62	32	3.0	Leakage prevention.
2015	59	33	3.0	
2030	52	34	3.0	
2055	32	32	3.0	
Lexton urban supply system – including some outlying properties				
Average yield: 45 ML/year		Unrestricted demand: 32 ML/year		
2006	14	1.0	0	Leakage prevention (committed option), and investigate groundwater (future option).
2015	16	5.0	3.0	
2030	42	34	33	
2055	31	31	33	
Dean urban supply system – including some outlying properties				
Average yield: 30 ML/year		Unrestricted demand: 19 ML/year		
2006	11	2.0	0	Leakage prevention.
2015	21	1.3	1.0	
2030	18	1.3	1.0	
2055	13	1.3	2.0	

Year	Surplus or deficit in water availability (ML) under Scenario B – medium climate change (assumes implementation of WSDS actions)	Surplus or deficit in water availability (ML) under Scenario D – continuation of low inflows of the past 10 years (assumes implementation of WSDS actions)	Water provided by WSDS actions (ML)	Major action being taken to meet supply deficit
Coliban Water				
Coliban urban supply system – including Bendigo, Castlemaine, Heathcote, Kyneton				
Average yield: 38,300 ML/year		Unrestricted demand: 37,200 ML/year		
2006	-1,000	-22,000	0	Construction of the Colbinabbin to Bendigo section of the Goldfields Superpipe. Construction of the Epsom – Spring Gully Recycled Water Project.
2015	31,000	8,000	36,000	
2030	23,400	4,000	36,000	
2055	8,000	-4,000	36,000	
Murray River urban supply system – includes Cohuna, Echuca, Gunbower and Leitchville				
Average yield: 6,300 ML/year		Unrestricted demand: -6,100 ML/year		
2006	0	0	0	Purchase of additional water entitlements on the market.
2015	4,500	1,500	5,000	
2030	3,000	0	5,000	
2055	4,500	2,000	10,000	
Goulburn River urban supply system – includes Boort, Pyramid Hill, Rochester and other smaller communities				
Average yield: 2,400 ML/year		Unrestricted demand: 2,000 ML/year		
2006	300	0	0	Purchase of additional water entitlements on the market.
2015	500	100	400	
2030	800	400	1,000	
2055	300	-100	1,000	
Loddon River urban supply system – includes Bridgewater, Dunolly, Inglewood and other smaller communities				
Average yield: 820 ML/year		Unrestricted demand: 610 GML/year		
2006	200	-300	0	System interconnections for Bridgewater and Inglewood to Bendigo. System interconnection of Serpentine to Goulburn system.
2015	350	-100	200	
2030	400	0	300	
2055	460	200	500	
Campaspe River urban supply system – includes Axedale and Goornong				
Average yield: 0.22 GL/year		Unrestricted demand: 0.19 GL/year		
2006	0	0	0	Purchase of additional water entitlements on the market.
2015	0.100	0	0.100	
2030	0	0	0.100	System interconnection of Axedale to Bendigo.
2055	0	0	0.100	
Groundwater supply system – includes Elmore and Trentham				
Average yield: 470 ML/year		Unrestricted demand: 310 ML/year		
2006	0	0	0	Purchase of additional water entitlements on the market.
2015	100	-100	0	
2030	150	0	100	
2055	0	0	100	

Year	Surplus or deficit in water availability (ML) under Scenario B – medium climate change (assumes implementation of WSDS actions)	Surplus or deficit in water availability (ML) under Scenario D – continuation of low inflows of the past 10 years (assumes implementation of WSDS actions)	Water provided by WSDS actions (ML)	Major action being taken to meet supply deficit
Goulburn Valley Water				
Goulburn–Broken River urban supply system – includes Mooroopna, Nagambie, Seymour and Shepparton				
Average yield: 33,500 ML/year		Unrestricted demand: 21,500 ML/year		
2006	12,000	-300	0	Water conservation.
2015	8,800	-2,100	400	Purchase of additional
2030	4,600	-4,400	1,700	water entitlements on the
2055	0	-5,300	6,500	market.
Murray River urban supply system – includes Barmah				
Average yield: 5,590 ML/year		Unrestricted demand: 4,880 ML/year		
2006	700	-600	0	Water conservation.
2015	0	-700	300	Purchase of additional
2030	0	-400	1,100	water entitlements on the
2055	0	-100	2,300	market.
Sunday Creek urban supply system – includes Broadford and Kilmore				
Average yield: 1,530 ML/year		Unrestricted demand: 1,530 ML/year		
2006	-10	Not calculated	0	Water conservation.
2015	0	Not calculated	500	Construction of the Goulburn
2030	1,600	Not calculated	2,700	River to Broadford pipeline.
2055	400	Not calculated	2,600	
Delatite River urban supply system – includes Mansfield				
Average yield: 420 ML/year		Unrestricted demand: 74 ML/year		
2006	-300	Not calculated	0	Water conservation.
2015	100	Not calculated	600	Construction of an off-stream
2030	400	Not calculated	1,100	raw water storage.
2055	0	Not calculated	1,000	
Lower Murray Water				
Lower Murray Water urban supply system – includes all communities from Koondrook to Mildura				
Average yield: 21,300 ML/year		Unrestricted demand: 20,600 ML/year		
2006	1,800	-1,600	1,200	Purchase of additional water
2015	3,600	1,100	6,500	entitlements on the market.
2030	2,300	1,100	10,500	
2055	800	2,000	17,800	

Glossary

Above-cap water

Water that is left over after limits on diversions have been reached. It also includes unregulated flows which cannot be kept in storage.

Adaptive management

Systematic process of continually improving management policies and practices.

Afforestation

The establishment of a forest by artificial methods, such as planting and direct seeding, on land where a forest would not have grown naturally.

Anabranch

A section of a river or stream that diverts from the main watercourse channel (or main stem) and rejoins the river downstream.

Aquifer

A layer of underground sediments which holds groundwater and allows water to flow through it.

Azolla

A native aquatic fern which grows in waterways in dense patches; its presence usually indicates high levels of nutrients.

Back-trade

Generally trade is permitted provided the traded water can readily flow to the destination trading zone. Trade is permitted in the opposite direction ('back-trade') if previous forward trade has opened up an opportunity.

Barmah Choke

A natural geographical constriction of the River Murray near the town of Barmah. The choke restricts the delivery of irrigation and environmental water and it may be possible to bypass the choke to alleviate channel capacity constraints to enable more effective delivery of water.

Baseflow

The component of streamflow supplied by groundwater discharge (or simulated from other environmental water).

Bulk entitlement (BE)

The right to water held by water corporations and other authorities defined in the *Water Act 1989*. Includes source bulk entitlements and delivery bulk entitlements.

Carryover

Allows entitlement-holders to retain ownership of unused water into the following season (according to specified rules).

Catchment

See river basin or system.

Catchment management authorities (CMAs)

Government authorities established to manage regional and catchment planning, and waterway, floodplain, salinity and water quality management.

Climate change

An extended period (typically decades or longer) where there is a statistically significant change in the 'usual' characteristics (averages and/or variability) of a place's climate.

Consumptive use

Water that is provided for all human uses (ie. non-environmental uses).

Critical human needs

The amount of water required to supply Stage 4 restricted demand in urban areas, domestic and stock needs and operate the distribution system to deliver that water.

Dead storage

Water held in the bottom of a storage that is below the elevation of the lowest constructed outlet.

Delivery bulk entitlement

Provides a set volume of water each year, subject to defined restrictions during periods of water shortages.

Delivery share

An entitlement to have water delivered to land in an irrigation district and a share of the available channel capacity in a delivery system. It is linked to land and stays with the property if the water share is traded away.

Desalination

Removing salt from water sources – normally for drinking purposes.

Distribution losses

See system operating water.

Diversions

The removal of water from a waterway via a pump. See also extractive use.

Drainage water

By-product of the distribution of irrigation water. Opportunistic reuse of drainage water is governed by rural water corporations through supply by agreements (sometimes called 'drainage diversion licences').

Drought response plan

Used primarily by urban water corporations to manage water shortages, including implementation of water restrictions.

Dry spell tolerance

The maximum period of time a species can cope with minimum flows or water levels without losing its ability to recover post-drought.

EC units/level

EC stands for electrical conductivity and is a measure used to indicate the salinity levels in water.

Effluent

Sewage that flows out of a sewage treatment plant.

Environmental Contribution Levy

An amount payable by urban and rural water corporations under the *Water Industry Act 2004* to promote the sustainable management of water and address adverse water-related environmental impacts.

Environmental flow regime

The timing, frequency, duration and magnitude of flows for the environment.

Environmental water reserve

The share of water resources set aside to maintain the environmental values of a water system.

Environmental flow studies

The study of the flow requirements of particular basin's river and wetlands systems used to inform policy decisions on the management and allocation of water resources.

Environmental entitlement

An entitlement to water currently held by the Minister to achieve environmental objectives in waterways.

Environmental manager

The government agency responsible for environmental outcomes for a relevant waterway. Could be the Department of Sustainability and Environment or catchment management authority.

Evapotranspiration

Water transfer to the atmosphere through direct evaporation from a surface and transpiration from an organism. For example, this can happen from evaporation of soil moisture, or transpiration through plants.

Extractive use

Water that is extracted for any human (consumptive) use or for the environment (for example, to water a wetland).

'Fit for purpose' supplies

Water that requires no further treatment for intended use.

Floodplain

Lands which are subject to overflow during floods. Often valuable for their ecological assets.

Flow component

Components of a river system's flow regime that can be described by timing, seasonality, frequency and duration (for example, cease to flow and overbank flows).

Freshes

Small and short peaks in flow; a 'flush' of water through a waterway.

Icon sites

There are six sites designated by the Living Murray Initiative as sites of importance: Barmah-Millewa Forest, Gunbower-Koondrook-Perricoota Forest, Hattah Lakes, Chowilla Floodplain/Lindsay-Wallpolla Islands, Lower Lakes/Coorong/ Murray Mouth and the River Murray Channel.

Gigalitre (GL)

One billion (1,000,000,000) litres.

Greenhouse effect

The enhanced warming of the Earth's atmosphere (global warming) attributed to increased atmospheric concentrations of the so-called greenhouse gases such as carbon dioxide and methane.

Greywater

Household water which has not been contaminated by toilet discharge, and can be reused for non-drinking purposes. Typically includes water from bathtubs, dishwashing machines and clothes washing machines.

Groundwater

All subsurface water, generally occupying the pores and crevices of rock and soil.

Groundwater management area (GMA)

Defined areas from which water is extracted from an aquifer, generally where groundwater has been or has the potential to be well developed.

Groundwater management plans

Created for water supply protection areas that have been proclaimed under the Water Act 1989 to ensure equitable and sustainable use of groundwater.

Headworks

Large dams, weirs and associated works used for the harvest and supply of water.

High-reliability water share

Legally recognised, secure entitlement to a defined share of water, as governed by the reserve policy.

Hydrological modelling

Simplified, conceptual representations of a part of the hydrologic cycle, used primarily for prediction of water behaviour within catchments and associated water supply systems.

Inflows

Water flowing into a storage or a river.

In-stream

The component of a river within the river channel, including pools, riffles, woody debris, the river bank and benches.

Licensing authority

Administers the diversion of water from unregulated waterways and the extraction of groundwater on behalf of the Minister for Water.

Living Murray Initiative

A water recovery project focussed on improving the environmental health of six icon sites in the Basin.

Low-reliability water share

Legally recognised, secure entitlement to a defined share of water, as governed by the reserve policy. Previously known as sales water.

Megalitre (ML)

One million (1,000,000) litres.

Murray-Darling Basin Cap

The limit set on the volume of surface water able to be diverted from each of the Basin's major river systems.

Non-residential water

Urban water use in industry, commercial/institutional buildings, open spaces (parks and gardens) and the distribution system.

Non-revenue water

Water within the urban reticulated system that is used to cover system losses/ leaks and non-chargeable activities such as fire services.

Passing flows

See system operating water.

Permanent trade

Transfer of ownership of a water share or licence.

Permissible consumptive volume (PCV)

The maximum volume of water permitted to be allocated in groundwater management areas. Previously called permissible annual volumes (PAVs).

Qualification of rights

The Minister of Water declares a water shortage and qualifies existing water entitlements to reallocate water to priority uses.

Recharge (to groundwater)

The process where water moves downward from surface water to groundwater due to rainfall infiltration or seepage/leakage.

Recycled water

Water derived from sewerage systems or industry processes that is treated to a standard appropriate for its intended use.

Refugia

Areas where plants and animals can take refuge, during times of climatic upheaval or biological stress. Refugia provide conditions suitable for survival of species that may be declining elsewhere.

Regulated systems

Systems where the flow of the river is regulated through the operation of large dams or weirs.

Reliability of supply

The volume and frequency with which water is allocated to entitlement-holders or water users. Key indicators for water shares are the frequency of full allocation and zero allocation years; for urban customers, the frequency of water restrictions.

Reservoir

Natural or artificial dam or lake used for the storage and regulation of water.

Reserve policy

Governs the balance between water allocated to entitlement-holders in a given year or kept in reserve for the following year.

Residential use

Water use in private housing.

Reticulation

The network of pipelines used to deliver water to end users.

Return flows

The portion of an allocation that the entitlement-holder

returns to the bulk supply system.

Riparian area

The interface between land and a stream. Important because of its influence on aquatic ecosystems.

River basin or system

The land into which a river and its tributaries drain.

Run-off

Precipitation or rainfall which flows from a catchment into streams, lakes, rivers or reservoirs.

Salinity

The total amount of water-soluble salts present in the soil or in a stream.

Seasonal allocation

The volume of water allocated to a water share in a given season, expressed as a percentage of total entitlement volume.

Sewage

Wastewater produced from household and industry.

Sewerage

The pipes and plant that collect, remove, treat and dispose of sewage.

Source bulk entitlement

A type of bulk entitlement held by water corporations to provide a share of inflows, storage capacity (if applicable) and releases.

Spillable water account

An accounting method for carryover to ensure entitlement-holders only lose their carryover when storages physically spill.

Stormwater

Run-off from urban areas. The net increase in run-off and decrease in groundwater recharge resulting from the introduction of impervious surfaces such as roofs and roads within urban development.

Stranded assets

Distribution infrastructure left with too few customers to pay for its maintenance when water entitlements delivered by that asset are traded to other systems.

Streamflow management plan

Plans prepared for a water supply protection area to manage the surface water resources of the area.

Sustainable diversion limit

The upper limit on winter-fill diversions within a unregulated river sub-catchment, beyond which there is an unacceptable risk to the environment.

Surface water

Fresh water that is visible above ground in rivers, wetlands and storages.

System operating water

Water released out of storages to operate river and distribution systems (to deliver water to end users), provide for riparian rights and maintain environmental values and other community benefits.

System reserve policy

See reserve policy.

Tagging of entitlements

Ensuring entitlements retain all of the characteristics (including reliability) of the source system when they are traded for use in another system.

Temporary trade

Transfer of ownership of a seasonal allocation.

Termination fee

One-off payment made by an entitlement-holder as a condition of surrender of a delivery share. Aims to address the risk of 'stranded assets'.

Transpiration

The transfer of water into the atmosphere from an organism (for example, the leaves and stems of plants).

Unbundling

Separation of traditional water rights into a water share, delivery share and a water-use licence.

Unincorporated groundwater areas

Areas with limited groundwater resources or use, which are not defined as groundwater management areas and do not have a defined permissible consumptive volume.

Unregulated systems

River systems with no large dams or weirs to regulate flow.

Water corporations

Government organisations charged with supplying water to urban and rural water users. They administer the diversion of water from waterways and the extraction of groundwater. Formerly known as water authorities.

Water entitlement

Volume of water authorised to be stored, taken and used under specific conditions.

Water entitlement-holder

Group or individual holding a water entitlement.

Water market

Market in which the trade of entitlements and allocations is allowed under certain conditions.

Water plans

Outline the services water corporations will deliver over a three-year regulatory period and the prices that they will charge.

Water right

Previously rights to water held by irrigators. As a result of 'unbundling', these have now been separated into a water share, delivery share and water use licence.

Water share

A water share is a legally recognised, secure share of the water available to be taken from a water system. It can be traded permanently or leased.

Water supply protection area (WSPA)

An area declared under the Water Act 1989 to protect the groundwater and/or surface water resources in the area. Once an area has been declared, a water management plan is prepared.

Water-use licence

Authorises use of water on a specific parcel of land.

Wetlands

Inland, standing, shallow bodies of water, which may be permanent or temporary, fresh or saline.

Winter-fill licence

A licence that permits the taking of water from a waterway during the winter months (normally 1 July and 31 October).

Yield

The quantity of water that a storage or aquifer produces.

Acronyms

ABA	allocation bank account	MDB	Murray-Darling Basin
ACCC	Australian Competition and Consumer Commission	ML	megalitre
AUL	annual use licence	N/A	not applicable
BE	bulk entitlement	NRSWS	Northern Region Sustainable Water Strategy
BSMS	<i>Basin Salinity Management Strategy</i>	NRM	natural resource management
COAG	Council of Australian Governments	NVIRP	Northern Victoria Irrigation Renewal Project
CEWH	Commonwealth Environmental Water Holder	NWI	National Water Initiative
CMA	catchment management authority	PCV	permissible consumptive volume
CSIRO	Commonwealth Scientific and Industrial Research Organisation	REALM	Resource Allocation Models
DSE	Department of Sustainability and Environment	RIVERS	River Values,
DPI	Department of Primary Industries	SAM	Southern Annular Mode
EC	electrical conductivity units (salinity)	SDL	sustainable diversion limit
EEA	<i>Environmental Effects Act 1978</i>	SEACI	South East Australia Climate Initiative
EES	Environmental Effects Statement	SFMP	streamflow management plan
ESC	Essential Services Commission	SWA	spillable water account
EPA	Environment Protection Authority Victoria	SWS	sustainable water strategy
EWR	environmental water reserve	TBD	to be determined
ETS	Emission Trading Scheme	VEAC	Victorian Environment Assessment Council
GL	gigalitre	VEFMAP	Victorian Environmental Flow Monitoring and Assessment Framework
GMA	groundwater management area	VEWH	Victorian Environmental Water Holder
GMU	groundwater management unit	VRHS	<i>Victorian River Health Strategy</i> (to be replaced by VSHREW)
HRWS	high-reliability water share	VSHREW	Victorian Strategy for Healthy Rivers, Estuaries and Wetlands
IVT	inter-valley transfer	WaterMAP	water management action plan
LRWS	low-reliability water share	WSPA	water supply protection area

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