Sustainable Water Strategy
Central Region
Action to 2055

Ballarat

Melbourne

Geelong

Latrobe Valley

Westernport

Our Water Our Future

A Victorian Government initiative

Victoria
The Place To Be

Contents

Foreword

This Sustainable Water Strategy sets out to secure water supplies for homes, farms, businesses, industry and the environment in Victoria's Central Region for the next 50 years. It is the result of a comprehensive 18 month consultation process with the community, including industry, local government as well as water and catchment management authorities. The process included a Discussion Paper, Draft Strategy, public meetings, public submissions and scrutiny by an independent panel of experts.

The Strategy builds on the *Our Water Our Future* Action Plan which is backed by the $320 million Victorian Water Trust-funded water campaign.

Our traditional sources of water, rivers and aquifers, are under pressure and must be protected. At the same time, towns and farms need secure supplies of water. This Strategy sets out how it is possible to meet both of these needs.

The Strategy aims to achieve the following objectives:

- ensure reliable and safe water supplies for all uses into the future
- understand the implications of climate change and be prepared for a range of possible future scenarios
- understand the implications of the record low rainfall and inflows to our reservoirs experienced over the past ten years
- protect and where necessary, improve the health of rivers, aquifers and estuaries
- protect the indigenous and other heritage values associated with the region's rivers and catchment areas
- maximise overall community benefits and ensure that no generation or group incurs unwarranted extra costs or receives additional benefits
- support high value water use by industry and agriculture with the least impact
- make the best use of water resources locally and throughout the region
- further develop an appreciation of the value of water and a conservation culture in the community
- aim to be greenhouse gas emission neutral.

The Government commits to a wide range of actions to help improve the health of our rivers and to secure water supplies for Melbourne, Geelong, Ballarat, the Inner West and the Latrobe Valley. These actions will continue to drive significant changes in the way we use and save water.

In order for this Strategy to succeed, it requires the commitment of all water users in the Central Region of Victoria – householders, farmers, businesses, water authorities and the Government.

Steve Bracks
Premier

John Thwaites
Minister for Water

The Strategy in brief

This Strategy provides a comprehensive plan for the sustainable use of water resources in the Central Region. The Central Region comprises the area south of the Great Dividing Range that includes the West Gippsland, Central Highlands, Barwon, Port Phillip and Westernport regions and the urban centres of Geelong, Ballarat, Greater Melbourne, Melton, Sunbury, Warragul and Traralgon.

The Strategy contains actions to improve river health and address water shortfalls in the Central Region that will arise in coming years due to the challenges of climate change and population growth. It is also important to be prepared for the possibility that the low inflows to reservoirs experienced over the past 10 years may continue.

On the basis of long-term average inflows to our reservoirs, it is estimated that an extra 280,000 megalitres (ML or million litres) of water will be needed for urban use by 2055 in the Central Region because of population growth and climate change. However, if the low inflows of the last decade continue, this extra water will be required much earlier. For example, if the low inflows continue, we will need an extra 145,000 ML for urban use across the region by 2015, increasing to 300,000 ML by 2055.

In addition, many of our rivers and aquifers are already stressed. The major rivers in the region require more than 110,000 ML of water to meet independent recommendations on environmental flow needs. It is important to keep our rivers and aquifers healthy so that they can continue to provide important environmental, economic and social benefits to the community.

In order to meet these needs and provide a buffer supply of water, the Strategy outlines actions that could provide an additional 400,000 ML of water for urban and industrial use in the region by 2055. An extra 66,000 ML of water will also be returned to our rivers by 2015, including the recommended flows for the Yarra and Barwon Rivers. As the Strategy is regularly reviewed over the next 50 years, opportunities will be explored to return additional water to rivers in which flow recommendations could not be met without compromising supplies to existing users.

Actions within the Strategy are based on the assumption that low inflow conditions may continue. This approach is less risky than assuming inflows will soon return to long-term average conditions, when there is no evidence to suggest that this is about to occur. Annual reviews of water availability and actual use compared to the forecasts will be undertaken. Actions can be brought forward or put back depending on the outcomes of the annual review of water availability.

Primary industries are a vital contributor to the State's economy. This sector, which accounts for 34 percent of water used in the Central Region will, like all users, be affected by reduced water availability as a result of climate change. However, unlike urban and industrial customers, agricultural users already have set water allocations and they are able to trade part or all of those allocations. This enables them to purchase additional water if required or sell unused water. The Government will continue its existing approach to managing water use in primary industries. This includes supporting increased efficiency both on-farm and within the water distribution system, capping rural entitlements from rivers and aquifers and enabling water trading.

There is no single solution to the problem of water scarcity. The Government will use a variety of approaches to secure our water future, including conservation and efficiency, re-use and recycling, interconnections and augmentations.

Key actions in the Strategy

Water conservation and efficiency

Using less water should be the starting point in addressing the challenge of water scarcity because it is generally the most cost effective solution and it has little or no environmental or social drawbacks. Conservation and efficiency also has a positive impact on greenhouse gas emissions.

The Government is setting water conservation targets to reduce total per capita water use across the region by at least 25 per cent (compared to the 1990's average) by 2015, increasing to 30 per cent by 2020. Separate residential and non-residential targets have also been set. Meeting these targets will mean:

- maintaining our current conservation culture using education and awareness
- more homes installing water–efficient showerheads
- more consumers selecting water efficient washing machines when replacing their old one
- householders committing to save water in the garden by selecting plants with low water needs and installing water–efficient garden devices
- commercial and industrial customers throughout the region that use more than 10 ML per year developing plans to cut water use
- water authorities improving the water distribution systems to reduce leaks and evaporation.

The conservation programs within this Strategy are forecast to provide about 100,000 ML of water by 2015, including maintaining existing savings within Melbourne of 42,000 ML.

Local recycling projects

Using alternative sources such as recycled water will become increasingly important as our traditional sources become scarcer, particularly because of the impact of climate change.

The Government is committed to a range of local recycling projects, including the use of recycled water for irrigators in the Werribee Irrigation District and south east of Melbourne, for Lake Wendouree and industry in Ballarat, for new residential and commercial developments in the south east and the inner west area of Melbourne and for Australian Paper in Gippsland. The Government will also pursue the use of recycled water for the Shell refinery in Geelong. In addition, a trial is to be conducted that, if successful, would see recycled water from the Black Rock Treatment Plant in Geelong being stored in aquifers for future recovery and use. A range of programs involving rainwater tanks and local stormwater, recycled water and grey water reuse will be implemented within Melbourne.

All of these projects collectively will free up about 14,000 ML of river water by 2015. This will increase to about 32,000 ML by 2030.

Large–scale augmentation for Melbourne

Inflows into Melbourne's reservoirs over the past 10 years have been significantly lower than in the previous 100 years. With climate change likely to significantly reduce water availability for Melbourne in the future, it is necessary to plan for the large–scale augmentation of Melbourne's water supplies.

The Government therefore commits to the next stage of the Eastern Water Recycling Proposal - preparing a business case. The Government will also initiate full feasibility studies and, if appropriate, proceed to business cases for seawater desalination and the reuse of stormwater collected near Dights Falls.

The Eastern Water Recycling Proposal involves an upgrade of the Eastern Treatment Plant to treat the water to Class A standard. Melbourne Water will proceed with the upgrade of the plant to tertiary filtration and disinfection based on technical design and business case. This upgrade would provide a foundation for the Eastern Water Recycling Proposal and potentially other recycling projects east of Melbourne.

Under the Eastern Water Recycling Proposal, water treated at the Eastern Treatment Plant would be piped to the Latrobe Valley for use in power generation. Currently the electricity generators and other major industry in the Latrobe Valley use about 117,000 ML of water a year for cooling and other industrial purposes. The water, which is sourced from the Latrobe River, is equivalent to about one quarter of all the water used in Melbourne, and about 12 times the residential water use in West Gippsland. The water could alternatively be used for drinking water supplies.

The Eastern Water Recycling Proposal would free up 139,000 ML of entitlements to drinking quality water - for environmental flows and urban use across Gippsland and Melbourne. It would also provide secure water for industry to grow in the Latrobe Valley. The Eastern Water Recycling Proposal has the potential to reduce the volume discharged at the Boags Rocks ocean outfall by 80 per cent per year on average. The feasibility of the proposal has already been assessed.

Connecting Ballarat to the Goulburn System

Within the region, the need for water is most urgent in Ballarat. In order to secure Ballarat's water future, the Government will connect Ballarat to the Goulburn system. This has been made feasible by the Government's decision to build a pipeline to connect Bendigo to the Waranga Channel in the Goulburn system. Ballarat will join this pipe and extend it to White Swan Reservoir near Ballarat. This will enable the two major regional centres of Ballarat and Bendigo to share water infrastructure. This connection will provide enough water to secure Ballarat's water supply immediately and in the long term. Water will be purchased from willing sellers and represents only a small proportion of the water in the Goulburn system.

Other actions for Ballarat include conservation and efficiency for homes and businesses, an interconnection to Cosgrave Reservoir in Creswick to allow access to a previously unused entitlement, and greater use of recycled water to supply Lake Wendouree and industry. In order to secure supplies during drought years, Central Highlands Water will also be entitled to access groundwater from the Cardigan aquifer.

Ballarat will continue to share water in the Lal Lal Reservoir with Geelong. Even if Geelong's share of Lal Lal Reservoir were transferred to Ballarat, it would not be nearly enough to meet Ballarat's future water needs.

Securing Geelong's water

By securing Ballarat's water future, Barwon Water is able to retain its share of Lal Lal Reservoir for urban use in Geelong. The Government will also grant Barwon Water a bulk entitlement for the deep Jan Juc aquifer. This will provide up to 7,000 ML of water, subject to a feasibility study and business case.

Barwon Water will also undertake detailed investigation of longer-term augmentation options including utilising the groundwater resources of Newlingrook aquifer and a connection to Melbourne. A decision will be made on the preferred option once the detailed investigations into the Newlingrook aquifer are complete in 2009.

Other actions for Geelong include conservation and efficiency at home and at work, pursuing the use of recycled water at the Shell refinery and minor augmentations, including the reinstatement of the Dewing Creek diversion.

Upgrading water systems and increasing supplies

There are currently 26 major reservoirs in the Central Region. These reservoirs were built on the best sites to provide cost-effective water supplies from the region's rivers. The appropriate sites have already been utilised. Our rivers like the Yarra, Maribyrnong and Moorabool are already suffering because of the amount of water extracted from them. More reservoirs would take more water from these rivers and stress them further. Accordingly, the Government does not support the construction of new in-stream reservoirs. However, the Government does support investment in the upgrade of existing dams to maximise their efficiency. The Strategy contains a range of augmentations based on reintroducing existing dams and diversion weirs to supply systems.

The existing infrastructure which connects Tarago Reservoir to the Melbourne water supply system will be reconnected in 2010, boosting water supplies by about 21,000 ML a year on long-term average flows or by about 15,000 ML a year if low inflows continue. This could provide even more water if inflows return to average conditions. The infrastructure was removed from the system in 1994 due to water quality issues. Before reintroducing this infrastructure to the supply system, a water treatment plant will be built.

Investing in healthier rivers and aquifers

Rivers provide vital water for homes, towns, farms and businesses and are a major drawcard for recreation and regional tourism. For many in the community, rivers have a special place in their memories and are deeply associated with their 'sense of place' and 'belonging'. This is particularly true for Indigenous Victorians.

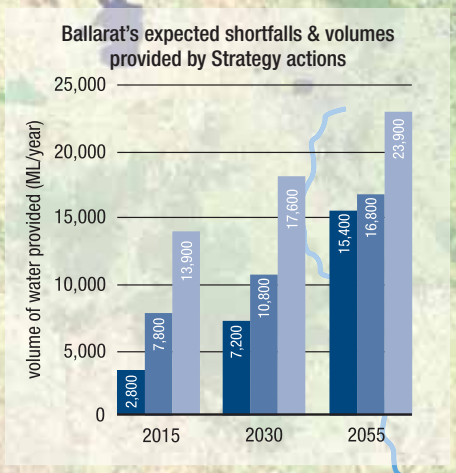
In addition, rivers are highly significant ecosystems in their own right. They support a large number of native plant and animal species (many of which are threatened or endangered) and provide a range of ecosystem services (eg. purifying water by natural processes) that are only now starting to be recognised and valued.

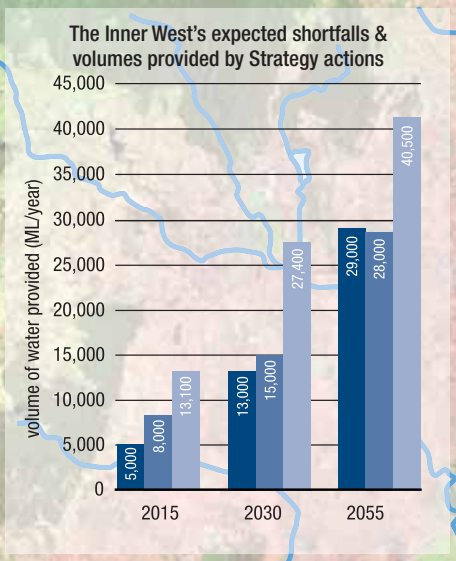
In order to protect these important values, the Government has created environmental water reserves for each of the major river systems in the Central Region. The environmental water reserves are a legally recognised share of water set aside for the environment.

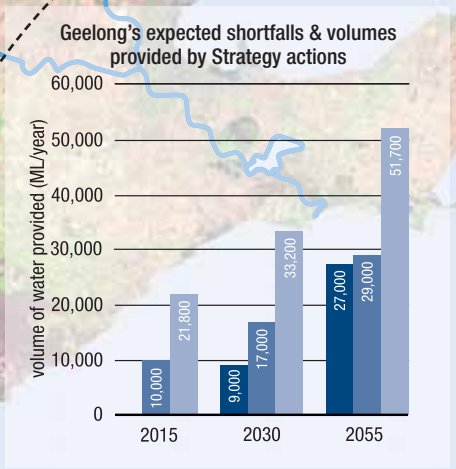
Environmental water reserves help to ensure the long-term health of our rivers, which are vital community assets. They allow our rivers to continue delivering important economic, environmental and social benefits to the community.

The Government will provide an extra 66,000 ML of water for the region's major river systems by 2015. Through this Sustainable Water Strategy, it has been possible to meet the independently recommended environmental flows for two of the major rivers in the region – the Yarra and the Barwon. The remaining river systems will be provided with additional flows which will help to meet environmental objectives identified as being important to the community. Opportunities to provide the full recommended flows, without compromising supplies to urban users and irrigators, will be developed in reviews of the Strategy. In the meantime, our rivers will benefit from increased flows and for the first time, a legal right to water.

Environmental water reserves will also be created for the major aquifers in the region. Together with continued groundwater management plans, this legally recognised share of water will help to ensure sustainable use of our groundwater resources.







Maribyrnong River

Leigh River

Werribee River

Moorabool River

Barwon River

Gellibrand River

Barwon/Leigh	ML/year
Proposed addition to current environmental flow regime	4,700
Action	
Continue discharge of treated recycled water to Leigh River	2,000
Reallocation associated with connection of Geelong to Newlingrook aquifer or Melbourne	1,000
Benefits from Fyansford quarry in lower Moorabool River	1,700
TOTAL:	4,700

Gellibrand
No proposed addition as current environmental flow regime is sufficient

Moorabool	ML/year
Proposed addition to current environmental flow regime	6,000
Action	
Redirect groundwater discharge from Fyansford quarry	3,000
Reallocation associated with Cairn Curran or Newlingrook aquifer	2,500
Voluntary buy-back of diversion licences	500
TOTAL:	8,500

Werribee	ML/year
Proposed addition to current environmental flow regime	6,000
Action	
Piping the Werribee Irrigation District	4,000
Substituting Werribee Tourist Precinct with recycled water	1,000
Allocating 50% of unallocated water in Merrimu Reservoir to environment	900
TOTAL:	5,900

Maribyrnong	ML/year
Proposed addition to current environmental flow regime	3,000
Action	
Reallocation associated with Rosslynne Reservoir and Barringo Creek	2,300
Voluntary buy-back of diversions licences	700
TOTAL:	3,000

Cape Otway

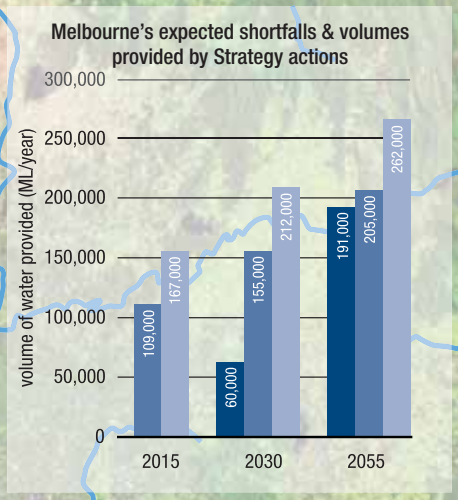
Otways Coast

Ballarat	ML/year
Shortfall by 2055	16,800
Volume from (low inflow) actions by 2055	23,900
Action	
Interconnect to the Goulburn system	18,000
Conservation and efficiency	4,500
Use of recycled water in Lake Wendouree	800
Interconnect to Newlyn Reservoir	300
Interconnect to Cosgrave Reservoir	300
TOTAL:	23,900

Geelong & District	ML/year
Shortfall by 2055	29,000
Volume from (low inflow) actions by 2055	51,700
Action	
Newlingrook and/or Melbourne connection	16,000
Conservation and efficiency	13,500
ASR of recycled water from Black Rock	12,500
Recycled water for use at the Shell refinery	2,000
Jan Juc deep aquifer	7,000
Dewing Creek diversion	700
TOTAL:	51,700

Inner West (Melton Sunbury & District)	ML/year
Shortfall by 2055	28,000
Volume from (low inflow) actions by 2055	40,500
Action	
Recycled water substitution for WID and BMID	15,000
Increased supply from Melbourne system	10,000
Conservation and efficiency	9,600
Use of recycled water for non-drinking uses in new developments	4,200
Minor augmentations	900
Use of recycled water from local treatment plants	800
TOTAL:	40,500

Central Region Sustainable Water Strategy
- The Challenges and Solutions



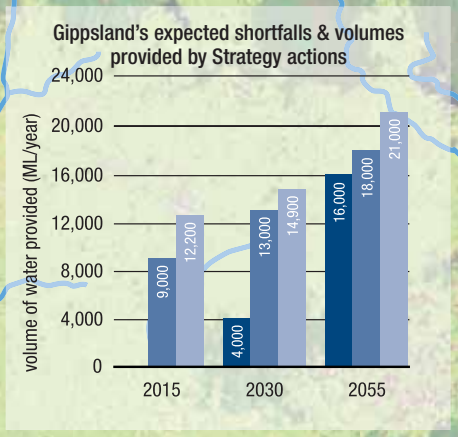
Yarra River

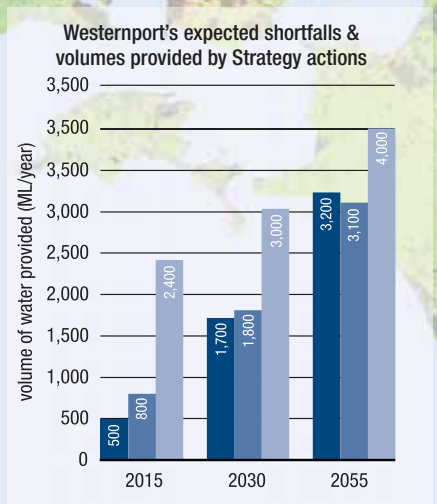
Thomson River

Latrobe River

Bunyip River

Yarra	ML/year
Proposed addition to current environmental flow regime	20,000
Action	
Increase environmental flow regime through Melbourne bulk entitlement process	20,000
TOTAL:	20,000





Thomson/Macalister	ML/year
Proposed addition to current environmental flow regime	15,000
Action	
Increase environmental flow regimes through *Our Water Our Future* initiatives	15,000
TOTAL:	15,000

Tarago/Bunyip	ML/year
Increase environmental flow regime	3,000
Action	
Increase environmental flow regime through bulk entitlement process	3,000
TOTAL:	3,000

Latrobe	ML/year
Proposed addition to current environmental flow regime	10,000
Action	
Assign part of unallocated water in Blue Rock Reservoir (to be confirmed on completion of seven-year detailed study)	10,000
TOTAL:	10,000

Melbourne	ML/year
Shortfall by 2055	205,000
Volume from (low inflow) actions by 2055	262,000
Action	
Eastern Water Recycling Proposal seawater desalination or stormwater reuse options	140,000
Conservation and efficiency	111,000
Local water recycling and reuse	10,000
Yarra irrigation efficiencies	1,500
TOTAL:	262,000

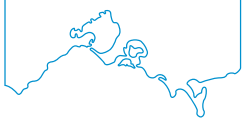
West Gippsland	ML/year
Shortfall by 2055	18,000
Volume from (low inflow) actions by 2055	21,000
Action	
Eastern Water Recycling Proposal or alternative	13,000
Conservation and efficiency	5,000
Stage 1 – Gippsland Water Factory	3,000
TOTAL:	21,000

Westernport	ML/year
Shortfall by 2055	3,100
Volume from (low inflow) actions by 2055	4000
Action	
Westernport - Melbourne connection, Corinella aquifer, Bass River or groundwater	3,000
Conservation and efficiency	960
Local reuse of recycled water	80
TOTAL:	4,000

Urban water shortfalls based on long-term average inflows to reservoirs

Urban water shortfalls based on continued low inflows to reservoirs

Volume of water provided by Strategy actions



1 Living within our water means

This Strategy outlines the Government's decisions and prioritised actions to secure our water future for people and the environment in the Central Region over the next 50 years.

A blueprint for our water future

As a community, we have to act now to ensure we have safe, reliable supplies of water for all water users into the future. We need to plan carefully to meet the demands of population growth, changing land uses, economic development and climate change. It is also important to be prepared for the possibility that the low inflows to reservoirs experienced over the past 10 years may continue.

If this occurs, it is forecast that by 2055, an extra 300,000 ML (megalitres or million litres) of water will be needed for urban and industrial use in the Central Region. If inflows return to long-term average conditions (and decline gradually in line with a medium climate change scenario), this urban shortfall is estimated to be 280,000 ML by 2055. This is equal to about 50 per cent of the urban water currently used in the Central Region. In addition, many rivers are already stressed and require about 110,000 ML of water to meet environmental needs and improve their long-term health. This equates to about 5 per cent of the region's average environmental flows.

In order to meet these needs and provide a buffer supply of water, the Strategy outlines actions that provide an additional 400,000 ML of water for urban and industrial use in the region by 2055. An extra 66,000 ML of water will also be returned to our rivers by 2015, including the recommended flows for the Yarra and Barwon rivers. As the Strategy is regularly reviewed over the next 50 years, opportunities will be explored to return additional water to rivers in which flow recommendations could not be met without compromising supplies to existing users.

This Strategy is based on the finding that there is no single action or easy solution to water scarcity, although water conservation is the first and best action because it is less costly and has a positive impact on greenhouse gas emissions.

The Strategy puts in place a range of immediate, short-term (2015), medium-term (2030) and long-term (2055) actions to meet our future water needs.

Immediate and short-term actions will ensure we have sufficient supplies if the current 10-year run of low inflows to reservoirs continue, as well as allowing time to plan and test the feasibility of other actions in the light of improving knowledge and technology. The Strategy is a dynamic document and will be reviewed and updated every seven to 10 years to take these developments into account. This update will be complemented by an annual review of the water supply and demand situation to test if the timing of actions needs to be adjusted and whether an earlier comprehensive review of the Strategy is required.

The Government, independent experts, the water industry and the community have worked together to develop this Strategy, which considers all of our water sources together across organisational and geographic boundaries and within a 50-year timeframe.

A new planning framework

Regional Sustainable Water Strategies are a key action from the Victorian Government's White Paper *Our Water Our Future*. They are a new planning framework for deciding on large-scale, long-term changes in water supply and use. The strategies set out actions to secure water for industry, cities and towns in a region while safeguarding the region's rivers and aquifers. They fulfil Victoria's obligation under the National Water Initiative (NWI) agreement to undertake transparent, statutory-based water planning.

The Central Region Sustainable Water Strategy is the first such Strategy to be completed. The Central Region comprises the area south of the Great Dividing Range that includes the West Gippsland, Central Highlands, Barwon, Port Phillip and Westernport regions and the urban centres of Greater Melbourne, Geelong, Ballarat, Warragul and Traralgon (see Figure 1.1).

Sustainable Water Strategies will be progressively developed for the remaining regions in the State. These are the Northern Region, Gippsland Region, South West Region and Wimmera-Glenelg Region. Work on the Northern and Gippsland regions will begin in 2007.

How the Strategy was developed - The Central Region Sustainable Water Strategy included:

1. Discussion Paper, released in October 2005, which contained a resource review and outlook, demonstrated the need to develop a long-term water resource plan across geographic boundaries. The paper included a list of options and invited community submissions to help identify further options.

2. Draft Strategy, released in April 2006, brought together the plans of the 12 water authorities and catchment management authorities that operate within the region and the options provided by the community. Proposals for community review and comment were developed by prioritising options in the short, medium and long term. The Draft Strategy explains our water sources and how they are used, the future pressures and risks to these sources, and the range of options investigated to manage these risks.

3. Final Central Region Sustainable Water Strategy contains the Government's decisions on proposals outlined in the Draft Strategy following community feedback through more than 100 public meetings and stakeholder forums and 437 community submissions. The Final Strategy sets out Government and community actions outlined in an implementation plan to secure our water future together over the next 50 years. It also responds to the immediate needs caused by the record low rainfall and inflows in to our reservoirs experienced over the past 10 years. It takes into account the findings of an Independent Panel of experts, chaired by Professor Peter Cullen. The Panel was appointed by the Minister for Water to consider comments made on the Strategy and make recommendations (see Appendix 1).

The Discussion Paper, Draft Strategy and Final Strategy together with the public submissions and Independent Panel report are available from www.dse.vic.gov.au

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Figure 1.1 The Central Region

What the Strategy aims to achieve

The objectives of the Strategy are to:

- ensure reliable and safe water supplies for all uses into the future
- understand the implications of climate change and be prepared for a range of possible future scenarios
- understand the implications of the record low rainfall and inflows to our reservoirs experienced over the past 10 years
- protect and where necessary improve the health of rivers, aquifers and estuaries
- protect the indigenous and other heritage values associated with the region's rivers and catchment areas
- maximise overall community benefits and ensure that no generation or group incurs unwarranted extra costs or receives additional benefits
- support high value water use by industry and agriculture with the least adverse impact
- make the best use of water resources locally and throughout the region
- further develop an appreciation of the value of water and a conservation culture in the community
- aim to be greenhouse gas emission neutral.

The guiding principles

The following principles have been adopted to help deliver the Strategy objectives:

Managing risk and uncertainty

- Use of an adaptive management approach will ensure that we will be prepared for the future as it unfolds.
- Decisions to implement options may be accelerated or decelerated to meet emerging needs and in light of new information.
- A buffer of contingency water (equivalent to seven years growth in demand) will be introduced for every urban water supply system to ensure there is time to select and implement new options as required.
- A diversity of options, from conservation and efficiency to alternative sources and augmentation, should be adopted to minimise the risk of future shortfalls.

Maximising flexibility

- Committing to interconnecting our water supply systems will maximise flexibility for water sharing across the region.
- Options currently not viable will be kept under consideration as new technologies emerge.
- Providing opportunities for individuals to make choices regarding their conservation methods will be a priority.

Greenhouse gas emission neutral

- Actions implemented under this Strategy, when considered together, will aim to result in no net increase in carbon dioxide emissions.
- Lower preference is given to options that generate high volumes of greenhouse gas.

Transparency

- Decisions should be transparent in terms of the benefits gained or costs imposed, including impacts to natural assets.

Sequencing

- The range of options that can be implemented without causing significant further risks to the health of rivers and aquifers is extensive and should be exhausted first.
- The timing of an option will balance the need to ensure that we have sufficient water while avoiding premature investment or investment in options that may not be needed in the future.

Shared responsibility

- Everyone needs to act to secure water.

Managing uncertainty

This Strategy is responsive to changing water needs. It includes immediate actions to meet short-term water shortfalls, work on developing options to meet medium-term shortfalls, and research of potential options to meet long-term water shortfalls (see Figure 1.2).

The past 50-100 years of climate behaviour, projections of future climate behaviour and population growth, have been used to develop plans for the future. However, it is also prudent to consider what actions would be needed to ensure we have sufficient supplies should the low inflows to reservoirs experienced over the last 10 years continue.

Water supply and demand actions in the Strategy have been brought forward in order to secure sufficient water supplies if low inflow conditions continue. If these actions were not brought forward, modelling shows that the continuation of low inflow conditions could cause an unacceptable frequency or severity of water restrictions or risk of running out of water.

An adaptive management approach is embedded in the Strategy review process to ensure it is responsive to the changing water resource outlook (see Chapter 5 for more information about adaptive management). Specifically, there will be an annual review of water availability and demand compared to the predicted forecasts. This will include an evaluation of progress in meeting targets. River flows and progress in meeting environmental targets will also be monitored. If necessary, the timing of actions will be adjusted through these annual reviews of water availability and demand.

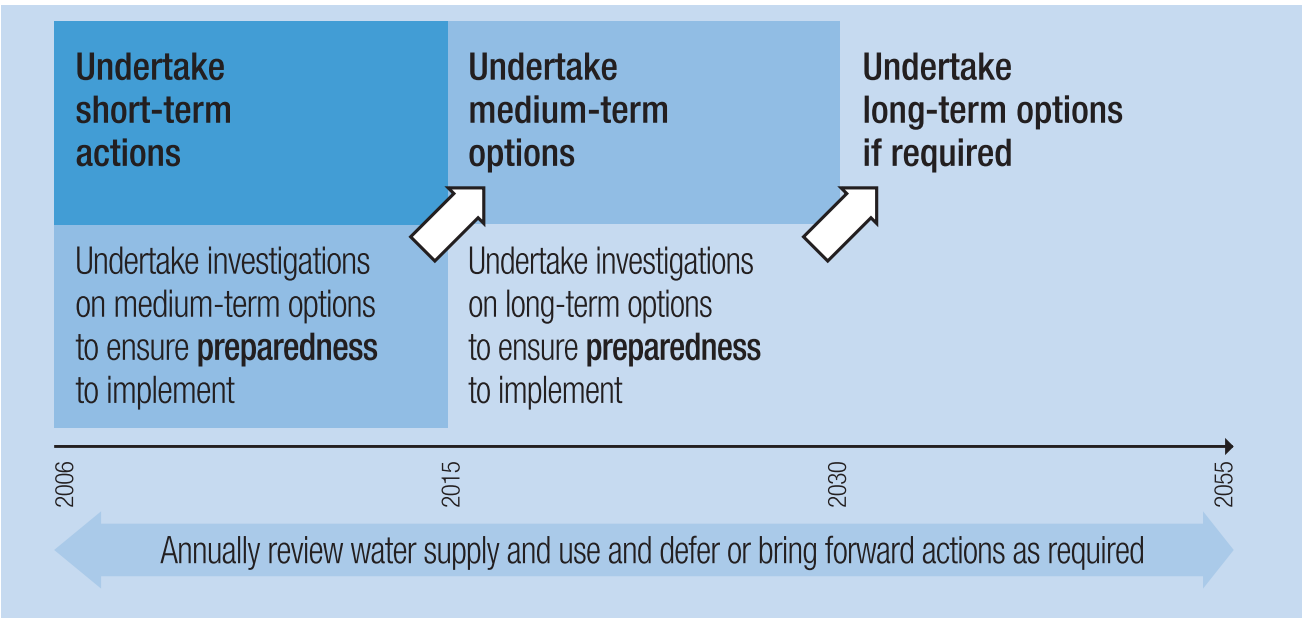
A review of the Strategy, as required by the *Water Act 1989,* will occur every seven to 10 years.

A further legislative requirement under the Act is an assessment of water resources at 15-year intervals. This assessment will determine if there has been a decline in water resources and whether this has fallen disproportionately on the environment or water users. It will also determine if river health is deteriorating for flow-related reasons. If either is the case, expert advice will be sought on appropriate corrective actions.

This responsiveness is especially important because of the uncertain impacts of climate change, and the need to include new knowledge and capture technology gains as they become available.

Finally, as part of managing uncertainty, the Strategy includes a buffer supply of water – equivalent to seven years growth – for urban areas to ensure there is enough time to put in place future initiatives to meet demand.

Figure 1.2 Elements of a Sustainable Water Strategy



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Aiming for a greenhouse neutral outcome

Given the impact climate change is likely to have on water availability, a guiding principle in developing the Strategy is that the actions implemented, when considered together, aim to result in no net increase in greenhouse gas emissions. In choosing future water supply options, lower preference will be given to options that generate high volumes of greenhouse gas.

Greenhouse gases will be generated as a result of producing new water supplies. The primary source of greenhouse gases is energy used to transport and treat water. The exact volume of emissions generated will depend on which long-term supply options are chosen.

The Strategy attempts to achieve greenhouse gas neutrality, through the pursuit of least-cost greenhouse gas abatement options. For example, water conservation measures (such as water-efficient showerheads and washing machines) effectively reduce the quantity of hot water we use – thereby reducing the amount of energy used to heat that water. Where this energy is supplied by fossil fuels, water conservation measures such as these have the potential to reduce greenhouse gas emissions.

While water conservation measures, including water-efficient appliances, such as showerheads and washing machines, will be expected to reduce greenhouse gas emissions to some extent, other aspects of water supply and use – such as the electricity used for pumping and filtration – will continue to produce significant quantities of greenhouse gas emissions. The Government will work with water authorities to examine least-cost ways of reducing, or offsetting, emissions resulting from actions in this Strategy. One possible means for doing so is a carbon offset tender, to reduce greenhouse emissions in the most cost-efficient way possible.

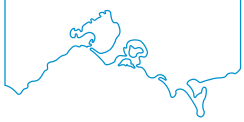
Tackling the causes of climate change

The Victorian Government is committed to reducing greenhouse gas emissions, and developing a low carbon future. The *Victorian Greenhouse Strategy 2002* and The *Victorian Greenhouse Strategy Action Plan Update 2005* demonstrate how the Government is tackling the causes of climate change.

The *Victorian Greenhouse Strategy* is positioning Victoria to achieve emissions reductions while protecting the economy and minimising costs to industry. Victoria will continue to pursue alternative forms of clean energy and will remain a nuclear-free state.

The release this year of *Our Environment Our Future* – Victoria's Sustainability Action Statement – demonstrates the major effort being made to put the principles of sustainability into practice. It contains a range of actions to improve the sustainability of the way we live and work. Key initiatives relating to climate change are:

- requiring energy retailers to buy 10 per cent of their energy from renewable sources
- investing in renewable energy research and commercialisation
- requiring Victoria's biggest 250 energy and water users to cut waste under new EPA laws
- establishing a new Research Centre for Climate Change to prepare for local impacts
- supporting "smart energy communities" to use solar and wind power
- helping households save energy with new "smart" power meters.



Implementation plan for the Strategy

Each action in the Strategy outlines the responsible organisation(s) and timeframes for completion. These make up the implementation plan of the Strategy which is a legislative requirement under the *Water Act 1989*. See Chapter 5 for more details about Delivering the Strategy.

The challenge

It is not possible to know what the future will be – instead we have to be prepared for the implications of a range of potential water futures. To do this, models that simulate future water availability and use are used that allow us to pose questions such as:

- What if there are more people using the same amount of water?
- How would different actions help to meet the needs of these people and the needs of rivers?
- What if the last 10 years of rainfall and low inflows to reservoirs continue instead of returning to average conditions?
- How might climate change affect water availability?

We are acting now because, if we did nothing, the demand for water could outstrip supply across the region by 2034. In some areas of the Central Region, such as Ballarat, this could occur before 2015. It is also necessary to consider the possibility that the below average rainfall and inflows to reservoirs over the last 10 years could continue. This would mean demand for water across the region could outstrip supply much sooner. This water scarcity is being driven by:

- population growth – estimated to increase from the current 4.2 million to 5.7 million by 2055
- economic development – from water-reliant industries
- land-use changes and events – likely to include bushfire, extensive revegetation, forestry management and an increasing number of small catchment dams
- climate change – estimated to reduce water in our rivers, aquifers, and reservoirs by anything from 7 per cent to 64 per cent by 2055.

These pressures will result in:

- increasing demand for water driven by population and economic growth
- increasing pressure on rivers and aquifers, many of which are already under stress because too much water is harvested from them
- less water being available in rivers, reservoirs and aquifers for people and the environment.

Population growth

A growing population means that in the future more people will require water. The challenge is to ensure sufficient water is available to supply the increasing population in a sustainable way.

The Central Region is home to 4.2 million people – 80 per cent of Victoria's population. Based on population projections developed recently[1], this is likely to increase to about 5.7 million by 2055. Much of the anticipated growth will occur in Melbourne's five growth areas: Wyndham, Melton–Caroline Springs, Hume, Whittlesea and Casey–Cardinia.

Economic development

In order for the Central Region to continue to grow and prosper, it is important to ensure that we have reliable, fit-for-purpose water supplies to retain and attract industry.

Most of Victoria's electricity is produced in the Latrobe Valley using locally extracted brown coal. While critical to the State's economy, this electricity production, including other coal-based industries, is water intensive. Other important economic activities that consume water in the Central Region include private forestry investment, irrigation, timber harvesting in the State forests as well as food production and processing.

For the purposes of this Strategy, industrial growth is generally assumed to keep pace with population growth.

Land-use change and events

Over the long-term, changes in land-use can have a significant impact on water resources. Land-use will change incrementally in response to society's changing needs. The challenge is to preserve choice and promote sustainable development that enables us to secure our water supplies.

Vegetation type and age are important influences on water yield. Timber harvesting regimes (in particular the spatial extent of harvesting and rotation length) also have the potential to significantly impact on water resource availability.

In some areas, an increase in the number of small catchment dams could have a considerable impact on water resources. Small catchment dams include dams for aesthetic or stock and domestic purposes, which are not subject to licensing.

In most areas of Victoria, the volume able to be captured in these dams is relatively small compared with other consumptive users. However, this is not the case in the Maribyrnong and Barwon systems, where these dams account for about half the water for consumption, and to a lesser degree in the Moorabool system. This affects all other users and the environment. With climate change, this impact worsens, particularly for the environment. As rainfall is reduced and the total amount of water available decreases, small catchment dams will divert a progressively larger proportion of this water by capturing run-off before it flows into rivers.

Increased peri-urban development is leading to an increase in lifestyle properties and the number and volume of small catchment dams. In response to these land-use changes, there is an opportunity to consider alternative water sources. This could include the installation of rainwater tanks, or reticulated systems that provide water from a central location to a number of properties. Elsewhere it may be possible to reduce the number of small, inefficient, leaky dams by building a smaller number of large efficient dams that reticulate water to the rest of the property.

Under climate change conditions, there will be an increased risk of bushfires. In native forests, bushfires present a potential risk to water quantity and quality. In contrast to land-use changes that occur gradually, bushfires are discrete events and are unpredictable. If bushfires occurred in the mature mountain ash forests in the water supply catchments supplying Melbourne and to a lesser extent Geelong, runoff would be reduced. However, it takes 10-15 years for bushfires to reduce yield. This is because mountain ash trees do not generally survive bush fires and young mountain ash forests (around 10 to 25 years old) use significantly more water than mature forests. Therefore, there is sufficient time to bring forward options to increase secure water supplies after a bushfire has occurred.

Water authorities have emergency plans in place in the event of bushfires in water supply catchments, particularly with respect to the impact on water quality that immediately follows bushfires.

A number of studies will be conducted in order to better understand the exact impacts of these various land-use changes. These studies are described in Chapter 5.

Climate change

There is now strong scientific evidence that climate change is happening. The world's reliance on fossil fuels for power generation and transportation and the resulting emissions of greenhouse gases are thought to be accelerating climate change by reducing the amount of heat that can escape from the Earth's atmosphere.

As a result of this change, Victoria is expected to become warmer and drier, with more frequent and extended drought periods and more extreme storms. Along with rising temperatures, there is also likely to be a significant reduction in rainfall, river flows and the amount of water supplied by our reservoirs.

Largely as a result of the high degree of uncertainty associated with future emission scenarios and the response of the climate system, there is a wide range of uncertainty associated with predicting the impacts of climate change on water resources. In order to manage this uncertainty, the Strategy takes an adaptive management approach, which includes monitoring and reviewing of climate change impacts (see Chapter 5 for more information about adaptive management).

Initial estimates of the impacts of climate change provided by CSIRO, forecast that streamflow in the region could be reduced by anything from seven per cent to 64 per cent by 2055. The impact of climate change on inflows to storages varies across the Central Region with catchments west of Melbourne being more adversely affected. These estimates are based on low, medium and high climate change scenarios. For all water supply systems within the region, the implications of low, medium and high climate change scenarios are considered. Across the Central Region, under a medium climate change scenario, this would mean an average 25 per cent reduction in available water by 2055 – about 900,000 ML less each year, affecting people and the environment.

Table 1.1 shows that, by 2055, this would mean about 300,000 ML less water each year from rivers and reservoirs for consumptive use. Current consumptive water use in the Central Region is about 1,020,000 ML.

Table 1.1 Implications of medium climate change for water availability in rivers and reservoirs in 2055

	Water availability without climate change (ML/year)	Water availability under a medium impact climate change scenario in 2055 (ML/year)	Difference (ML/year)	Per cent reduction in water availability
Consumptive entitlements	1,250,000	950,000	300,000	~ 25%
Environmental flow regime	2,500,000	1,900,000	600,000	~ 25%

For the purpose of estimating water availability for the Central Region, it is assumed that the impact of climate change is borne in approximately the same proportion by consumptive uses and the environment within each river basin. Any future decision on how the impacts of climate change will be allocated between water users and the environment will be made as part of the long-term water resources assessment process introduced in the recent water resource management legislation, an amendment to the *Water Act 1989*.

The past 10 years of low inflows

Inflows to reservoirs in the last 10 years have been well below the previous long-term average. The reductions in inflows range from 30 per cent to 60 per cent across the Central Region. As an example, Figure 1.3 shows the inflows to the Lal Lal Reservoir over the past 75 years. Table 1.2 shows the reduction in stream flows experienced in the major rivers of the Central Region over the past 10 years and the expected reduction in 2055 as a result of medium climate change.

Figure 1.3 Trends in inflows to Lal Lal Reservoir over the past 75 years

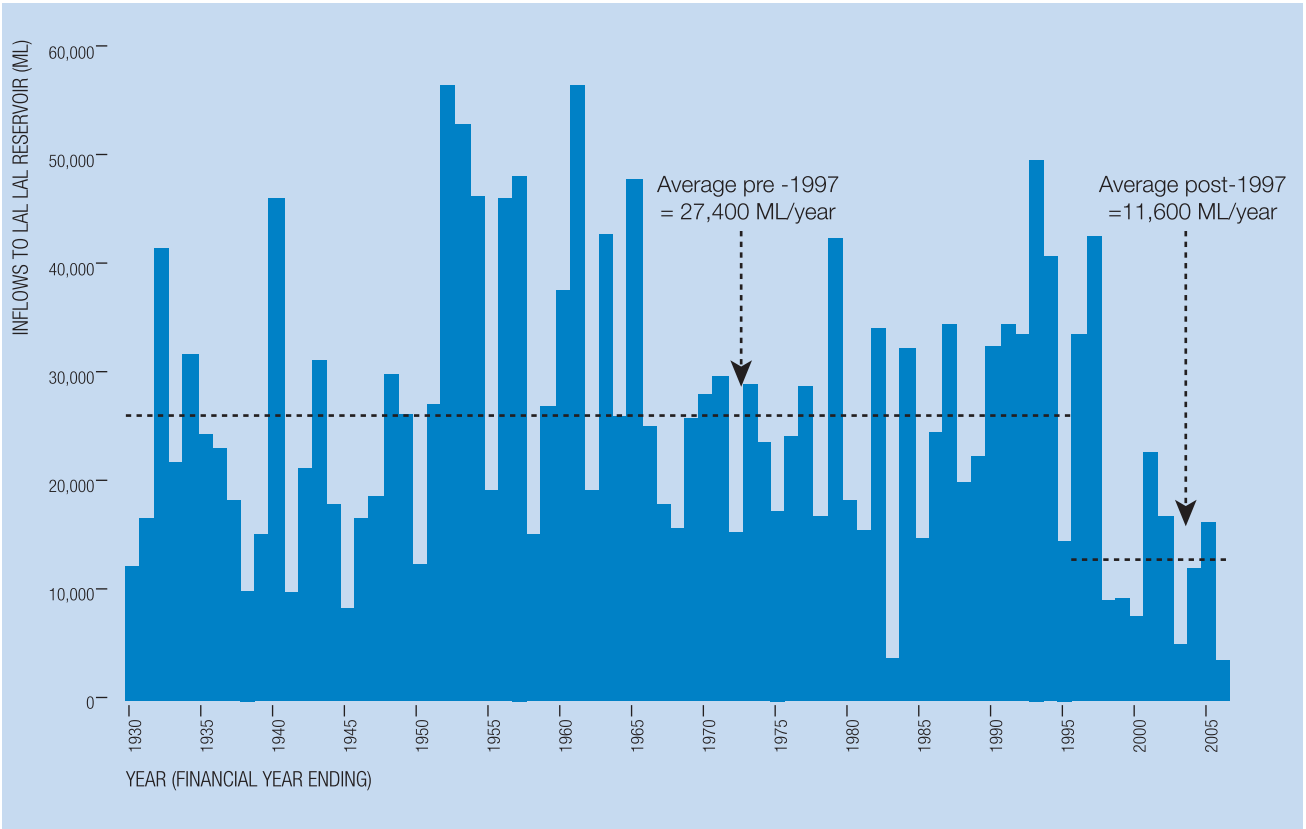


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Table 1.2 The reduction in stream flows over the past 10 years (compared to the long-term average) and the reduction expected in 2055 as a result of medium climate change

River system	Reduction in stream flows experienced over the past 10 years	Forecast reduction in stream flows in 2055 as a result of medium climate change
Barwon	34%	28%
Moorabool	60%	32%
Werribee	51%	33%
Maribyrnong	41%	32%
Bunyip/Tarago	41%	24%
Yarra	29%	23%
Latrobe	53%	19%
Thomson/Macalister	34%	23%

The reduction in stream flows experienced over the past 10 years appears to be slightly more severe than the reductions expected in 2055 as a result of medium climate change.

This 10 year pattern is not isolated to the Central Region – it is occurring right across Victoria as well as in New South Wales and Queensland.

It is possible that this is simply an episodic dry period, similar to those experienced in the past – notably between 1895 and 1903 and between 1938 and 1946. The current period of low rainfall and inflows is slightly more severe than these earlier events.

It is also possible that the low inflows experienced since 1997 represent a permanent step down in reservoir inflows linked to climate change. In south-west Western Australia, low rainfall and stream flows resulted in a similar step reduction in water supply in the mid 1970's. Since that time, streamflows have been reduced by about 50 per cent, and by up to 64 per cent in the past few years. Research has indicated that the step change in inflows is likely to be a result of the early onset of climate change and natural climate variability.

Forecasting future inflows

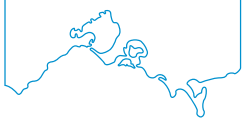
The Strategy uses two different forecasts of inflows to reservoirs.

The first forecast assumes a return to average inflows (based on the past 50-100 years) with a gradual reduction (due to medium climate change) over the next 50 years. This scenario was presented in detail in the Draft Strategy.

The Draft Strategy was prudent to plan for climate change assuming a progressive reduction in inflows over the next 50 years.

However, between the release of the Draft Strategy in April 2006 and the finalisation of the Strategy in October 2006, there were record low winter/spring inflows. It is forecast that dry conditions will continue for the rest of the year. Inflows over the past 10 years have been well below the long-term average and there has been increasing severity of restrictions around the region. This has made it imperative that we also plan on the basis that low inflows will continue into the future and consider the possibility that the impacts of climate change involve a step reduction in water supplies, rather than a gradual reduction over 50 years.

Therefore, the second forecast assumes a continuation of the low inflow conditions of the past 10 years. The dry conditions of the last 10 years are more severe than anything experienced over the past 100 years. While a continuation of these dry conditions would be an extreme situation, it is emerging as a real possibility that we have to plan for. Reduced inflows would mean that reliability of water supplies would be reduced.



Reliability of water supplies

Typically, an acceptable level of reliability for major cities is around 95 per cent. This means water restrictions would be expected no more than five per cent of the time. Restrictions are introduced during dry periods as an integral part of effective drought response. In smaller systems, reliability might be around 90 per cent, with water restrictions expected no more than ten per cent of the time. If no action was taken, the impacts of population growth and climate change would impact on reliability and restrictions would need to be enforced more regularly.

There will be costs associated with taking action to maintain existing levels of reliability. In the future, community discussion and input will be required for decisions about what an "acceptable" level of reliability is.

Modelling allows us to forecast water availability for both long-term average inflows and the low inflows of the past 10 years. For each scenario, demand for water is assumed to increase over time in line with population growth projections.

Technical reports of the modelling assumptions and results can be found at www.dse.vic.gov.au

Long-term average inflows

The first forecast used in this Strategy is based on long-term average stream flows and inflows to reservoirs over the past 50-100 years. This forecast shows a gradual reduction in supply over 50 years due to medium climate change. Combined with projected population growth, this results in a 280,000 ML urban water shortfall by 2055. Under this forecast, there is more time to plan and implement actions to provide safe reliable water supplies. These forecasts were presented for each sub-region in detail in the Draft Strategy.

Continuation of low inflows

Given that inflows to reservoirs over the past 10 years have been 30-60 per cent lower than the previous long-term average, it is important to be prepared for the possibility that these low inflows may continue. The following scenario was modelled for each supply system in the Central Region:

What happens to the region's water supplies in the future if there is the same variability from the past 50-100 years (ie. some wetter years and some drier years), but every year has about 30-60 per cent less stream flow (depending on the supply system)?

The results of this modelling show that, for all areas of the Central Region, reliability of supply would be impacted, with an increased likelihood and severity of restrictions. In Melbourne, reliability would be reduced to about 82 per cent compared to the target of 95 per cent (ie. restrictions expected 18 per cent of the time compared to five per cent). Areas like Ballarat, where storage levels are already very low, would be most at risk. Reliability would be only 25 per cent, with restrictions in place about three-quarters of the time, often at Stage 4 level.

In order to provide sufficient water supplies under a low inflow scenario, accelerated action will be needed to restore reliability of supplies around the region to an acceptable level. The Strategy sets out an action plan that will provide sufficient water for all areas of the region under this scenario. Chapter 4 outlines the volumes of water that would be required for each sub-region, and the actions that will provide it.

A continuation of the last 10 years of low inflows would effectively mean that a greater portion of the long-term shortfall would be incurred in the short-term, rather than increasing gradually over the next 50 years. This forecast shows an immediate urban water shortfall of 145,000 ML, increasing to 300,000 ML by 2055.

If low inflows continue, the likelihood of this being a result of natural variability alone would be small and it may be necessary to base future planning on permanently reduced stream flows (as occurred in Perth).

Victoria is participating in a three-year, multi-million dollar research program (South East Australian Climate Initiative) aimed at better understanding the factors influencing our climate (see Table 5.2/ *Our Water Our Future* Action 2.19). The results of this work will inform decisions about the inflow scenarios that should be used in future water plans.

The need for annual reviews

It is important to plan for the possibility that low inflows to reservoirs may continue and be ready to take immediate action to secure our water supplies. The immediate actions for each sub-region (outlined in Chapter 4) are based on the assumption that low inflow conditions will continue. This approach is less risky than assuming inflows will soon return to average conditions, when there is no evidence to suggest that this is about to occur. The consequences of managing our water supplies for average inflows, if they do not eventuate, are unacceptable. In addition, investments made on the basis of continued low inflows are unlikely to be wasted. They will certainly be needed in the long-term to provide for population growth and climate change.

Annual reviews of water availability and actual use compared to the forecasts will be undertaken. If the reviews show that inflows have returned to more average conditions, the volumes of water required will be reconsidered. If actions can safely be deferred, they will be.

The impacts of continuing low inflows on river health and groundwater resources are outlined in Chapter 2.