# Water Challenges

*for South Australia in the 21st Century*

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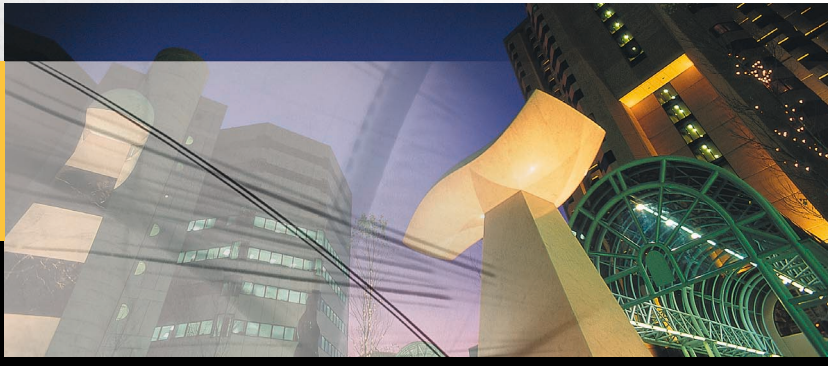

**Peter Cullen**
Thinker in Residence 2004

Government of South Australia

# Water Challenges for South Australia in the 21st Century

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# Peter Cullen

Professor Peter Cullen has worked in the field of natural resource management for over 35 years. He was awarded the Prime Minister's Prize for Environmentalist of the Year in 2001 for his work on the National Action Plan for Salinity and Water Quality.

Peter is a graduate in Agricultural Science from the University of Melbourne and his major professional work has been in the areas of nutrient dynamics, eutrophication, lake ecology and environmental flows. He is a member of the International Water Academy and a Director of both Land and Water Australia and Landcare Australia Limited. Peter was also founding Chief Executive of the Cooperative Research Centre for Freshwater Ecology, where he served from 1993–2002.

Peter is now a Professor Emeritus of the University of Canberra, where he was Dean of Applied Science. He is a member of the Community Advisory Council, the Murray-Darling Ministerial Council and is Chair of the Scientific Advisory Panel for the Lake Eyre Basin Ministerial Forum.

Peter is known internationally as the leader and spokesperson of the Wentworth Group, a coalition of leading Australian scientists, economists and thinkers formed to address the emerging national debate about the use and management of Australia's natural resources.

## The following partners were involved in Peter Cullen's residency:

Department of the Premier and Cabinet
Department of Water, Land and Biodiversity Conservation
CSIRO
SA Water

# Foreword



The water situation in South Australia has become critical. The sclerosis of the River Murray, gross wastage of water, the impact of salinity and inefficient irrigation, the need to decrease demand for water, reduced rainfall, and our inability to properly harness the water we do have – these are just some of the issues we need to address.

I do believe, however, that South Australians are coming to realise that we now need to act with some urgency. We know water is fundamental to life, and that we cannot continue to use and abuse it in the way we have for nearly two centuries. Perhaps most importantly, we understand that we cannot tackle our water problems by using the same style of thinking that helped get us into this situation in the first place. Obviously, a fresh, bold approach is needed.

This report, by Professor Peter Cullen, clearly and compellingly outlines where South Australia finds itself in regard to water in 2004. He explains the sources of our problems and details the many threats to a sustainable water supply. But he also makes arguments about how we might remedy the situation – putting forward 18 specific recommendations.

More than just a report, *Water Challenges for South Australia in the 21st Century* is the culmination of Professor Cullen's extremely valuable work under the Adelaide Thinkers in Residence program. Following on from Thinkers such as Herbert Girardet and Charles Landry, Peter truly engaged South Australians on the issue of water. In particular, he involved the most important custodians of our water resources: our youth. Peter has greatly improved our "water literacy" – the capacity of the State to debate the issue of water and to make decisions.

Overall, Peter Cullen's work fulfilled the aims of the Adelaide Thinkers in Residence program, which is to stimulate discussion on matters vital to the State. He has successfully brought new perspectives to the debate, while at the same time transferring skills, advising government and educating community leaders.

I thank Professor Cullen for his outstanding contribution, and I commend this report to anyone who is concerned about the future of South Australia.

**Mike Rann**
Premier of South Australia
September 2004

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**Acknowledgement**

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# Preface



I had the great pleasure and privilege to live and work in Adelaide during the first half of 2004 as a Thinker in Residence. This is a remarkable program, established by the South Australian Premier Mike Rann to bring scholars from a range of fields to live and work in South Australia. This provided me with a wonderful opportunity to talk with many people and groups and gain an understanding of how South Australians view water.

As an outsider, this was a chance to identify and question some of the assumptions that South Australians bring to the water issue. My findings will not necessarily be comfortable for those involved, but the role of a friend is to point out things that it might be easier to ignore. As someone who lives in an upstream State, I bring a different perspective to these issues, but I also share the passion of many South Australians to protect the great River Murray system.

Many South Australians often feel hostage to the upstream States who take so much of the water of the Murray to support irrigation. Since Federation, South Australia has sought to influence how other States use the waters of the Murray, and it is critical to the future of the State that these efforts continue.

However, there is much that South Australia itself must do to protect the health of the River Murray. There is now an opportunity to develop a water management system for the 21st Century, to manage land and water in South Australia and to be an exemplar for upstream States and other countries on how to live in a dry country.

While South Australia has done some excellent things in its water management, there is still much to be achieved. In this report I seek to lay out what might be the next steps in this journey to sustainability.

My work builds on the important foundations of two previous Thinkers in Residence. Herbert Girardet (2003) recognised the importance of water in creating a sustainable Adelaide and identified several areas that are examined further in this report. Charles Landry (2003) identified the economic opportunities that could be created from the sustainability agenda. Landry identified a culture of constraint – that South Australians were great at talking and less good at doing, and pointed out the tendency for "rules to determine policy, strategy and vision – rather than vision, policy and strategy to determine rules."

This report identifies eighteen actions that South Australia needs to take in its journey to sustainability. Some are new and others have been considered before, but left as too hard. The time is here to stop talking and start doing if South Australians are to be prepared for the water challenges facing us all in the 21st Century.

So many people helped make our stay in South Australia enjoyable and memorable. Thanks to Denise Maddigan and Ann Clancy from the Thinker in Residence program of the Premier's Department, Rob Freeman, Chief Executive from the Department of Water, Land & Biodiversity; Anne Howe, Chief Executive of SA Water and Dr Wayne Meyer from CSIRO who were partners in my visit.

Many colleagues helped make us feel welcome and provided stimulating discussions and comments on the issues on which I report. In particular I would like to thank Mike Young, whose friendship and insights I value very greatly. I also would like to thank Lynn Brake, John Cugley, Peter Dillon, Tim Flannery, Kym Good, Paul Harvey, John Hill, Peter Hoey, Rob Lewis, Jim McColl, Jack McKean, Dennis Mutton, John Radcliffe, Jane Roots, Claus Schonfeldt, Rob Thomas and finally the Young Thinkers who worked with me during my visit Dr Justin Brookes, Dr Brett Bryan, Mr Jonathan Clark, Ms Sarah Morgan, Miss Rebecca Neumann, Ms Amy Paparella, Dr Paul Pavelic, Ms Louise Tedmanson, Mr Doug Turner and Ms Mardi Van Der Wiesen. My thanks to all of these people.

The responsibility for the opinions and suggestions in the report, of course, rest with the author.

**Peter Cullen**
August 2004

# Executive Summary

Australia is entering a period of increasing water scarcity. Water is wealth in rural Australia and there are many who seek to use water for productive purposes. We are, however, realising that we have taken too much water from the River Murray, caused significant degradation and governments are now seeking to recover water for the environment. There is a possibility we are undergoing long-term climatic change that may mean there is less water to share between these competing uses.

In this context of emerging water scarcity it is hardly appropriate for the people of Adelaide to go on living as though they are in a well-watered European city with abundant water. While in the past the River Murray has been a secure source of water, there is little doubt there will be increasing demands for its waters and there are significant concerns that irrigation in South Australia is leading to increasing salinity that might restrict the use of the River.

South Australia needs to harnesses the creative skills of its research and business community to work with governments and the regional Natural Resource Management Boards to develop water management strategies appropriate for a dry country in the 21st Century. Taking this path will not only secure the future of the State by ensuring water is available, but it will also provide opportunities to export these approaches around the world. By showing leadership the State will be better able to influence upstream States to change their ways and address their water issues.

This report contains eighteen recommendations for action, of which seven are seen as priorities. There are four areas for action.

First, understand and protect the sources of water. These include addressing flow and salinity issues in the River Murray and controlling land use in the Hills catchments. Recommendations 2, 4, 7 and 9 are priorities.

Second, use water efficiently in urban and rural communities to reduce demands on this scarce and precious resource. This will involve further development of water entitlements and a water market. Recommendation 1 and 13 are the priority.

The third area is to develop and learn how to use alternative sources of water. These include recycling, using stormwater and developing capability for desalination of seawater and saline groundwater. These are less urgent, but they will take time, so a start should be made.

The fourth area is to develop the capacity of rural communities to live sustainably in their catchments by providing appropriate support to the new Natural Resources Management Boards. Recommendation 17 is the priority.

# List of Recommendations



### Recommendation 1

The Government should establish a high-level review team to determine how to align South Australian water entitlements with those being developed in other States. This review team will need to become familiar with changes being implemented in other States, to review water access entitlements and the rules for water trading in South Australia, ensuring they reflect best practice and meet the National Water Initiative requirements to be compatible with other States. The review team should be made up of a State official with experience in managing water resources, a representative of the irrigation community and an expert in water entitlements and markets from a research or consultancy organisation.

### Recommendation 2

Irrigators should take communal responsibility for the cost of operation of the salt interception schemes that have been built with public money. Salt management is a basic part of the irrigation enterprise and probably should be built into water prices. The Government should implement a salt trading system for individual landholders to provide rewards for those who demonstrate best practice salt management.

The Government and the River Murray Catchment Water Management Board or its successor should amend the Water Allocation Plan to explicitly define salt interception zones, high and low salinity hazard zones and the salt trading rules within each zone and ensure water is not traded into high salinity hazard areas.

### Recommendation 3

Where public funds are used to assist in improving water use efficiency, all or a proportion of the water licence should revert to the Government. Governments should not provide special support to least efficient irrigators; this just makes it harder for efficient operators. An effective water market allows the inefficient to leave the irrigation industry with a financial windfall as they sell their water.

### Recommendation 4

South Australia should create a River Murray Environmental Water Trust to hold environmental water in South Australia, to seek additional water using whatever State, Federal or other funding may be available and to seek philanthropic donations of money or water, and to work with NRM Boards to deliver water to protect specific agreed environmental assets. The Trust needs to work closely with an environmental manager, responsible to the Murray Darling Basin Ministerial Council.

### Recommendation 5

The South Australian Government should undertake a comprehensive ecological study of Lake Alexandrina the Coorong, Lower River and Murray Mouth to inform management about the needs of this important environmental asset and ensure it can be managed effectively. This will require a three-to-five year study and should identify future trajectories of the ecological assets, under different salinity regimes and during wet and dry periods. The study would benefit by engaging indigenous knowledge of the Coorong and how it functions.

### Recommendation 6

The South Australian Government should continue to explore the ecological benefits of raising and lowering water level in weir pools of the River Murray, working with the community to explore what can be done in this regard to improve the health of the river.

### Recommendation 7

South Australia should appoint one of its Murray-Darling Basin Commissioners to speak from a whole-of-government perspective. The second Commissioner position should be used as an opportunity to appoint an expert in a relevant area, with a five-year term, to provide some substantive knowledge amongst Commissioners and to ensure some stability that has not been attainable with the frequent changes of heads of agencies.

### Recommendation 8

SA Water should be required initially to stabilize per capita consumption within three years, and then to reduce it by ten percent within ten years. Consideration should be given to having SA Water responsible to the Minister for Environment and Conservation, as well as the Minister for Administrative Services, to ensure sustainable water use is given equal status with generating revenue.

The Government should encourage water-sensitive urban developments in new areas and in major redevelopments by a range of measures including zoning, subsidy and development charges. The Government should develop a single whole-of-government water conservation program rather than have several competing programs.

### Recommendation 9

The Government should take the following actions to protect the Hills catchment:

- Proclaim the catchments under the water resource provisions of the new Natural Resources Management Act to control farm dams and bores from extracting more water from the catchment.
- Require metering for all commercial extractions from surface or groundwater.
- Demand effective land use planning that prevents further urban development in the catchments and insist on the appropriate infrastructure to deal with sewage.
- Strengthen the Mt Lofty Watershed Protection Office and let it expand its programs to assure compliance with pollution control requirements.
- Pay landholders who contribute good quality water for the ecosystem services they provide to the community; charge those who contaminate waterways.

### Recommendation 10

SA Water should be encouraged to use recycled water as a replacement for potable water in appropriate uses and should work with the development industry to encourage this in new developments and redevelopments.

# Recommendations



### Recommendation 11

The Government should clarify the control and responsibility for stormwater and encourage its use as a commercial resource, as water supply for appropriate uses. A roundtable conference between the environmental regulator, the health regulator and the relevant research community should negotiate an appropriate regulatory environment that encourages the development of aquifer storage and recovery, as well as a pricing and management regime to protect groundwater.

### Recommendation 12

The Government should develop a State policy towards desalination that addresses planning issues, access to saline water, disposal of brine and management of other environmental impacts. The support the Government may provide to appropriate proposals could be outlined to encourage innovation in this area.

### Recommendation 13

The South Australian Government should establish an Independent Price Regulator to review and establish appropriate urban and rural water prices in South Australia. The National Water Initiative provides an excellent framework for implementing this without delay.

### Recommendation 14

The Government should consider putting the water supply of remote communities out to tender to foster innovation and development of the most cost effective approach to water supply for these communities. Any cross-subsidy needs to be transparent.

### Recommendation 15

State agencies need to work together to support the NRM Boards with resources and appropriate knowledge, and should clearly articulate the wider State interest that must be incorporated into plans.

### Recommendation 16

The Centre for Natural Resources should identify appropriate research expertise for various issues within the State and elsewhere, and develop a knowledge strategy for regional bodies that identifies knowledge gaps and make these known to the research community, as well as make specific investment in priority areas.

### Recommendation 17

The Department of Water, Land and Biodiversity should facilitate and support "communities of practice" of key people from each Natural Resources Management Board and the technical community, to meet three times a year to share information and experiences in the specific areas of interest.

### Recommendation 18

The State needs to implement an integrated water assessment program that provides data on streamflow, water quality, river health groundwater depth and quality. These data need to meet the needs of a range of data users, and should be publicly available. Periodic interpretative reports should be made available, perhaps through State of the Environment reporting.

# 1. Introduction



South Australia is Australia's driest State. Almost ninety percent of the State has a rainfall of less than 300mm, and Adelaide has an average rainfall of 555 mm. South Australia has the lowest mean annual runoff of any State, with only 1937 GL in 2000-1. Not only is the rainfall low, but also it is very variable and long dry spells can be experienced.

Australians have often made decisions about land and water without understanding these natural resources. As a consequence, great misery has been created for landholders, together with considerable environmental damage. Optimistic assessments in a few good years in the 1880s saw early attempts to develop cropping in areas of South Australia that could not be sustained under more normal rainfall. The stark ruins of homesteads that dot these areas are testimony to the hardship such misunderstandings have caused landholders. In more recent years, we have not understood that the salt in our landscapes would be mobilized by the application of excessive irrigation water and by the clearing of deep-rooted native vegetation. The resulting salinity of the River Murray continues to put at risk all those who depend on the river for water, as well as the River itself.

Knowledge is essential for living in a dry continent like Australia, but it is not enough. Communities and governments need to use the knowledge we have and make sure that our activities do not put at risk the resources upon which we all depend. Charles Landry, as a previous Thinker in Residence, talked about South Australia's "culture of constraint" – great at talking and less good at doing. This is not an option we can afford with water resources. Not taking key decisions is, in fact, a decision to use the water in a particular way that may not be in the best long-term interests of the wider community.

The wish to develop our country and create wealth for rural communities has often led to inappropriate development. Sometimes we have encouraged the wrong use of the land; in other situations we cut corners and did not invest in the infrastructure needed to allow for sustainable land use. The failure to develop drainage in irrigation developments and the failure to provide sewerage systems in urbanising areas in the Hills catchments, are examples. In most of these situations there was a desire to transfer the costs of particular development from those undertaking the development to the wider community at some later date. The costs of the environmental degradation are borne by all of us and by our successors.

In our two hundred years of living in this country white Australians have made many mistakes and learned some harsh lessons about living in our dry country. The ways we think about and use our water resources are the key to the future of our country and to the State of South Australia.

This study of water and sustainable landscapes in South Australia was undertaken in the first half of 2004, a period when much of Australia was in the grip of a particularly savage drought which has made both urban and rural Australians aware of the scarcity of water to meet our needs.

There are concerns that our climate seems to be changing and that rainfall may be decreasing and evaporation increasing, as we move into hotter and drier periods with even more variable rainfall. In the last twenty years the rainfall in Perth has fallen by fifteen percent of that experienced over the previous seventy years. This has caused the runoff to drop around thirty percent, with serious economic consequences to the city. Some well-regarded climate experts believe the same trend is now starting in Eastern Australia. As we plan for the use of our water resources into the 21st Century it is prudent to develop systems that can cope with less water in our rivers.

There are four elements to addressing this issue as we enter the 21st Century.

- Protect catchments so that land uses do not degrade the quantity and quality of water entering our rivers and groundwater systems.
- Manage rivers and groundwater so that we maintain the health of these systems and understand that they are the foundation upon which all other uses depend. They are not some optional extra that can be achieved after we have taken all we want from the rivers.
- Demand that urban and rural Australians use our limited water resources as efficiently as possible, so that we reduce the demands on our already stretched water resources.

- Develop alternative sources of water, including urban stormwater, recycled water and the use of desalination of seawater and saline groundwater.

These are not just challenges for South Australia; they are national and indeed global challenges. If South Australia can take a leadership role in these issues there are international economic opportunities, since it is predicted that half of the world's population will be facing water scarcity within twenty-five years. To exploit these global economic opportunities as well as meet the needs of South Australian communities, a more innovative approach to managing water resources will be needed. South Australia needs to harness the creative abilities of its research community and link them with the water business cluster that is being built. There is a need to engage the research and business community more effectively to help manage the water resources in the State and demonstrate how to do this to Australia and overseas.

# 2. The Murray Lifeline

Australians value the River Murray for its ecological, recreational and cultural aspects, as well as for its value as a water resource to the Murray-Darling Basin and to Adelaide. Many Australians feel strongly about the Murray and want to see it managed in a more sustainable way.

The River Murray is critical to South Australia and since before Federation has been an issue for South Australia with the upstream States (Cullen, 2003). As the NSW Premier at the time of Federation, G H Reid put it, "NSW was not prepared to reduce itself to the status of a catchment for South Australia" (quoted by Wright, 1978). Little seems to have changed. South Australians understand and appreciate the importance of the water of the Murray to their State and frequently express concern about how the river is managed by upstream States.

There is a real opportunity for South Australia to demonstrate best practice water management in the 21st Century, both to maximize the value the State obtains from its water but also to encourage upstream States to develop better water management practices. The National Water Initiative, agreed in 2004, provides a new forum for this, complementing the existing Murray-Darling Basin arrangements.

## 2.1 The Importance of Irrigation

Irrigated agriculture is important to South Australia and some 1300 GL of water is applied to 163,000 ha of land. Irrigated agriculture has a gross value at the farm gate of $1.4 billion. Irrigation uses about eighty percent of all water extracted in the State.

Some 570 GL per year is extracted directly from the Murray for irrigation and there is significant use of groundwater for irrigation in South Australia.

Table 1 shows how irrigation water is used in South Australia and the gross value of each industry. It must be stressed that gross value does not consider the various other input costs, so is not a measure of profitability or efficiency in any way. Gross value should not be used as a proxy for the highest value water use. This table does however show that eighty three percent of the gross value created through irrigation comes from less than forty percent of the water. These values refer to the commodities, not the processed products that come from the commodities.

This situation is made more obvious in Table 2, which shows the relative performance of the irrigation industries in other Southern States of the Murray-Darling. It would seem from Table 2 that pasture irrigation in South Australia produces considerably less gross value per ML of water than pasture irrigation in Victoria. This would suggest that there is much room to increase the value of pasture irrigation in South Australia, or alternatively, that it may be better to withdraw water from pasture irrigation

**Table 1**
**Agricultural Water Use in South Australia, 2000-1**
(Source – ABS Water Account)

| | Water Used | Area | Water Applied | | Gross Value | |
|---|---|---|---|---|---|---|
| | GL | '000ha | ML/ha | $m | $/ML | $/ha |
| Pasture | 474 | 51 | 9 | 110 | 232 | 2157 |
| Dairy | 320 | 23 | 14 | 126 | 394 | 5478 |
| Vegetables | 65 | 14 | 5 | 248 | 3815 | 17,714 |
| Fruit | 161 | 18 | 9 | 235 | 1460 | 13,056 |
| Grapes | 284 | 57 | 5 | 685 | 2412 | 12,018 |
| Total Agriculture | 1302 | 163 | 8 | 1405 | 1079 | 8620 |

**Table 2**
**Comparative Water Use and Gross Margins ($/ML) from Irrigated Agriculture**
(Source – Derived from ABS Water Account)

| | South Australia | | NSW | | Victoria | |
|---|---|---|---|---|---|---|
| | ML/ha | $/ML | ML/ha | $/ML | ML/ha | $/ML |
| Pasture | 9 | 232 | 5 | 124 | 7 | 315 |
| Dairy | 14 | 394 | 6 | 444 | 5 | 567 |
| Vegetables | 5 | 3815 | 5 | 2375 | 5 | 3550 |
| Fruit | 9 | 1460 | 8 | 1042 | 8 | 1770 |
| Grapes | 5 | 2412 | 5 | 1293 | 7 | 1378 |
| Total | 8 | 1079 | 6 | 324 | 6 | 691 |

and redistribute it to other sectors. Care must be taken in interpreting these relative figures since aspects like soils, rainfall and the level of investment, as well as the skill of the farming community, are all relevant factors.

Table 2 also shows that overall South Australia produces greater gross value per ML of irrigation water than other States. There are a number of reasons for this, including a more efficient delivery system to farms, more secure water licenses and the mix of agricultural enterprises that is supported.

Interstate water trading has seen a total of 14 GL of water traded into South Australia from Victoria and NSW between 1996 and 2001. In drought years of 2001-02 and 2002-03 South Australia was a net exporter of 4 GL and 7.5 GL respectively. The long-term future water movements under a national water market are however hard to predict.

## 2.2 The Impacts of Irrigation

Applying water to land has two major impacts that have to be managed if the benefits of irrigated agriculture are to outweigh the costs. The first impact relates to changes in the hydrologic regime through the storage of water in reservoirs, its delivery down river to irrigators in summer when the river would have naturally have had low flow, and the impacts of reducing flood when the river and floodplain connect. The second impact relates to the application of water to land and the mobilisation of salt that can be induced.

We now have tools for assessing river health that incorporate biological outcomes (initially invertebrate populations, but now moving to include fish and other biota). These measures of river health commonly also include the drivers of change which include water flow, water quality and aquatic habitat. The most comprehensive measure of river health is the tool developed as the Sustainable Rivers Audit by the Murray-Darling Basin Commission and released in 2004. This provides a series of objective measures that can be used to assess the overall health of a river. There is little doubt that these tools will continue to develop.

Assessing river health is not a simple task, and there are some interest groups in the community who either do not understand the assessments being undertaken, or who dispute the findings that rivers are impacted by their activities. The relationship between river health and the range of activities in a catchment, such as water extraction, changing vegetation and hence runoff, water pollution and the loss of riparian vegetation, is also complex and is often contested. It is important to assess the range of factors that might damage a river and make judgments regarding which are the critical factors that must be addressed to restore health to our waterways. These are difficult judgments; they are especially difficult for community groups who may have to change the way they use the natural resources available to them.

There has been considerable scientific work on the health of the River Murray and there is no doubt that water management has caused

a considerable impact on the health of the river (Harris & Gehrke, 1997, Norris et al, 2001, Kearney & Kildea, 2004).

The major impacts have been due to:

- Reduction in flow downstream of irrigation communities, causing slow moving reaches suitable for algal growth.
- Alteration to flow with unseasonally high flows in summer when water is needed by irrigation and low flows in winter and spring as dams refill. This causes wetlands connected to the river to be flooded at unseasonal periods, causing changes in plant communities.
- Mobilising salt in the landscape that can degrade land and waterways.
- Pollution with nutrients and organic matter from urban sewage disposal and runoff and from agricultural runoff.
- Blockage of fish movement with weirs.
- Maintaining constant water levels behind weirs, removing the riparian wetting-drying cycles important to nutrient dynamics.
- Damage, through grazing and boating activity, to riparian vegetation that protects riverbanks, leading to bank erosion.

Governments and local communities are attempting to address these various elements. At present considerable debate is underway as to how to find the 1500 GL of water that scientific work indicates must be returned to the river to give it a reasonable chance of good health.

Another impact being addressed relates to the sub-surface drainage water that seeps through the plant root zone and dissolves salt from the soil. This water enters aquifers and then finds its way to the river. Commonly, irrigators apply excess water to leach the salts below the root zone so they will not impact on plant growth. This excess water and salt causes the groundwater to become more saline. There can be long lag times before these effects become apparent in the river. Failure to address these salinity issues effectively is a serious risk factor for the long-term health of the river and all of the uses dependent upon it.

On the other hand, improved water use efficiency may lead to less water finding its way to rivers, hence increasing the need for enhanced environmental flows.

## 2.3 A Sustainable Irrigation Industry?

For irrigation to be sustainable, irrigation and drainage must be conducted in a way that does not degrade the quality of land, surface and groundwater systems and other natural resources that contribute to both agricultural production and environmental quality (Oster & Wichelns, 2003).

A sustainable irrigation system will have the following characteristics:

- It extracts only a sustainable amount of water from the river systems to ensure that river health is maintained.
- Water is applied to crops as efficiently as possible so that losses in delivery and application are minimized. The amount applied meets plant needs and a minimum of water is used for leaching salts. This requires a high level of water control.
- Farm level and regional efforts will minimise, intercept, isolate, reuse and dispose of saline drainage water, rather than allowing it to degrade the land or rivers.
- There will be transparent accounting for the net effects of irrigation on river flow and aquifer yield.
- Irrigators will understand the capacity of their soils and drainage systems to support various forms of agricultural production. They will have the skills and capacity to produce a range of crops that maximise the wealth coming from the water used, without damaging our environment.

It seems likely that irrigation, as practiced in the Murray-Darling Basin in 2004, fails to be sustainable on any of these criteria.

South Australia has not over-allocated the available water in the way some upstream States have done, so is not facing the problem of recovering water from irrigation. There has been considerable public investment in water delivery systems to farms that sees most water piped, rather than transported in open channels, which can lose up to thirty percent of water through seepage and evaporation. These are fundamentally important steps and give South Australia an excellent foundation on which to build.

Nevertheless, there are some challenges facing irrigation in South Australia. These are:

- How to ensure water is used efficiently.
- How to encourage water to move to the best economic use, to maximise the wealth created for rural communities from irrigation.
- How to address the salinity challenge that threatens the health of the river and the uses on which it depends.
- How to contribute and manage environmental water, ensuring both the best environmental outcomes from available environmental water and that other management actions are not unduly damaging river health.

These are challenges for irrigators, the agricultural industries and for the Government.

## 2.4 Sharing the Water of the Murray

Under the Murray Darling Basin Agreement, South Australia is entitled to 1850 GL from the Murray and this is secure water that is available most years. However in 2003-04, only 1753 GL was received by South Australia. This reduction in Entitlement Flow was accepted by South Australia to minimise the risk of more severe restrictions late in the irrigation season, as a result of the ongoing drought.

**Table 3**
**Average Annual Runoff and Water Use, Murray-Darling Basin (GL/yr)**
(Source – Murray-Darling Basin Commission Water Resources Fact Sheet, 2003)

| State | Runoff | Surface water used [1] | Groundwater used |
|---|---|---|---|
| NSW | 11295 | 6265 | 935 |
| Victoria | 9319 | 3975 | 119 |
| South Australia | 132 | 720 | 30 |
| Queensland | 3104 | 584 | 148 |
| ACT | NA | 33 | 1 |
| **Total** | **23850** | **11576** | **1233** |

[1] In Table 3, the surface water used has been taken as the cap figure, which for South Australia, is greater than the water actually used.

**Table 4**
**South Australian Use of River Murray Water (GL/yr, averages over five years)**
(Source – Department of Water, Land & Biodiversity)

| | |
|---|---|
| Metro Adelaide & associated country areas | 126 |
| Lower Murray Swamps | 97 |
| Country Towns | 36 |
| Other Irrigation | 430 |
| Environmental | 1161 |
| **Total** | **1850** |

The average runoff of the upper reaches of the Basin has been estimated to be 23,850 GL per year, with a further 1200 GL transferred into the Basin from adjacent catchments.

In the Lower Murray much water goes to support extensive wetlands surrounding the river, and under natural conditions a median flow of 11,318 GL per year would have reached the barrages. With the current level of diversions, only twenty-seven percent of this now reaches the barrages.

There is strong scientific evidence that the river needs an additional 1500 GL of flow to restore its health, and that South Australia may need to find a share of this. Urban growth is causing increased pressures to take more water for urban users. It is assumed this will come from upstream irrigation, which may become possible if a national water market is established.

## 2.5 Water Entitlements and an Effective Water Market

South Australia signed the Intergovernmental Agreement that is the National Water Initiative in June 2004. The Agreement commits the State to ensure that its water entitlement system meets various criteria. This provides a real opportunity for South Australia to review its water entitlement approach and ensure a best practice model that gives a real foundation for creating wealth in rural communities, as well as protecting the environment. It is suggested that the key elements of such an entitlement system would include irrigators being given:

- a water entitlement, which is a perpetual share (as a percent) of the available water resource, which needs to be a secure asset that can be traded
- an annual allocation reflecting the available water that year (in ML)
- a share in the available delivery capacity of infrastructure to get water to the property
- a site licence to use the water in a particular way on the property. This is the means by which government can require farmers to be using Best Available Practice irrigation.

South Australian politicians, through the Adelaide Declaration, undertook to "show leadership in management of the Murray-Darling Basin system in South Australia". Both Victoria and NSW are moving to new systems of water entitlements that have some differences. There is a need, not only for South Australia to update its allocation system, but a unique opportunity to work with the other States to harmonise the entitlement system in the three States that can underpin interstate trade in water.

**Recommendation 1**

*The Government should establish a high-level review team to determine how to align South Australian water entitlements with those being developed in other States. This review team will need to become familiar with changes being implemented in other States, to review water access entitlements and the rules for water trading in South Australia, ensuring they reflect best practice and meet the National Water Initiative requirements to be compatible with other States. The review team should be made up of a State official with experience in managing water resources, a representative of the irrigation community and an expert in water entitlements and markets from a research or consultancy organisation.*

## 2.6 Addressing the Salinity Threat

Salinity is an ongoing threat to the health of the River Murray. Over half of the salt in the Murray at Morgan comes from South Australia. The salt load to the river has doubled, due to clearing of mallee country and the development of irrigation. There is a natural inflow of salt into the Murray in South Australia of around 900 tonnes per day. The clearing of mallee country has added a further 175 tonnes a day and irrigation developments, up until 1988, are contributing 550-700 tonnes a day (Cole, 2004). Irrigation developments since then will contribute a further 42 tonnes a day over the next thirty years and 250 tonnes per day over one hundred years. Future trades and irrigation development may increase this load unless they are well controlled. Until recently, the Murray has been treated as a salt drain by allowing excessive irrigation water to flow down to the groundwater and then into the river.

We now have new tools for identifying salt in the landscape which can be used to guide management interventions. In non-irrigated areas this means appropriate planting of deep-rooted plants in places where they will lower

the groundwater and prevent salt coming to the surface. The challenge now is to find appropriate sanctions and incentives to make sure this is done.

In irrigated areas it means reducing the amount of water applied to land by using modern micro-irrigation techniques, aiming for minimal drainage. The Government has now stopped the expansion of irrigation into high salt hazard areas and has invested in salt interception schemes to take salty water away from the river into evaporating basins. The irrigation delivery systems are largely piped, which gives good system efficiency.

It is desirable to make all irrigators accountable for the impacts of the salt that they mobilise as part of the cost of production, rather than see this as a public cost.

**Recommendation 2**
*Irrigators should take communal responsibility for the cost of operation of the salt interception schemes that have been built with public money. Salt management is a basic part of the irrigation enterprise and probably should be built into water prices. The Government should implement a salt trading system for individual landholders to provide rewards for those who demonstrate best practice salt management.*

*The Government and the River Murray Catchment Water Management Board or its successor should amend the Water Allocation Plan to explicitly define salt interception zones, high and low salinity hazard zones and the salt trading rules within each zone and ensure water is not traded into high salinity hazard areas.*

## 2.7 Improving Water Use Efficiency

It is obvious that if we can transport water to a farm and use it efficiently, then less water has to be extracted, meaning more is available for either commercial or environmental purposes. As the House of Representatives Standing Committee on Agriculture, Fisheries and Forestry said in its 2004 report on water, public investment to improve water use efficiency should result in water being transferred to the Government.

It is also important to recognise that improving the efficiency of water use may result in less water in rivers. At present some of the water lost through inefficient water delivery systems finds its way into rivers and provides some of the current environmental flow. This means such saved water may not be available to re-allocate to other users.

However, it is clearly important to maximise the efficiency of water use – to minimise the take of water from the Murray, to minimise the impacts of salinisation from over-watering and to maximise the wealth that rural communities can achieve from irrigation. The establishment of clear water entitlements, the development of a national water market and the development of water use licences to minimize salinity and other environmental impacts, will all help achieve this.

On farms, losses through seepage and evaporation of some twenty-four percent are common. Reducing these losses offers opportunity to reduce the water being applied, with consequential benefits both to the rivers and to the waterlogging and salinity issues.

Many of our irrigation industries have made considerable investments to improve their water use efficiencies in recent years. An improvement of around thirty percent in water use efficiency has been achieved in some industries. One area where progress has been slow is in irrigation of pastures for dairy production, where some irrigators produce less than thirty kilograms of milk product per millilitre of water while others can achieve over one hundred. The differences relate to soil, farm size, farmer skills and levels of investment in up-to-date irrigation systems, that allow adequate control of water.

Some dairy farms in South Australia along the Murray, between Mannum and Wellington, are reputed to have used up to fifty-five ML of water per hectare. Restructuring of the dairy industry in this area is underway. SA Water has purchased some properties, both the land and the water in separate transactions, to use the water for other purposes. Managing the landscape and managing assets stranded, as water is traded out of an area, are particular challenges in this region now. Modern irrigation practices in vineyards have been able to reduce water use from 8-10 ML per hectare, down to 5-6 ML per hectare.

Profligate use of water not only damages the rivers the water is taken from, but the waterlogging, salinity and other pollution that can come from such inept irrigation can be disastrous to the sustainability of those regional communities, who then commonly call for taxpayer funds to bail them out.

It is important for individual irrigators, regions and industries to see how they are performing in comparison to others. The way to do this, is to establish an effective benchmarking exercise that reports publicly on the performance of each sector and region of the irrigation industry in SA. South Australia has agreed, under the National Water Initiative, to implement the benchmarking system developed by the Australian National Committee on Irrigation and Drainage (ANCID). The costs of this benchmarking will be built into water costs (section 76 National Water Initiative). If information on water use for each crop type and for each region is available, individual farmers can compare their performance with others, while Governments can focus their investments to achieve better outcomes.

**Recommendation 3**
*Where public funds are used to assist in improving water use efficiency, all or a proportion of the water licence should revert to the Government. Governments should not provide special support to least efficient irrigators; this just makes it harder for efficient operators. An effective water market allows the inefficient to leave the irrigation industry with a financial windfall as they sell their water.*

## 2.8 Managing Environmental Water

The National Water Initiative commits the States to clear statutory licences for environmental water and to ensure this water is managed effectively across State boundaries. There are two functions required:

- to recover water for the environment in the most cost-effective manner possible
- to use this water to protect the ecological integrity of identified ecological assets.

In my view, the best way of doing this is for the Southern Basin States to establish a Murray Environmental Water Trust to carry out both of these functions in the most cost-effective manner. It should be a skill-based body, reporting to the Murray-Darling Basin Ministerial Council, but should also be required to protect ecological assets on tributary streams, as identified by the States.

However, given the realities of interstate water management, it seems that this is unlikely. It is more likely that each State will independently develop strategies, which will need to be accepted by the Murray-Darling Basin Ministerial Council, for recovering water. Perhaps the best that can be expected, is that each State sources water through its independent mechanism and that this water be pooled under an effective environmental manager, who is responsible for delivering the water to the agreed environmental assets and reporting on the effectiveness.

Connor and Young (2003) have reviewed the options for a South Australian-based Water Trust, and, failing agreement with other jurisdictions, SA should establish such a Trust as the second-best option. Its role should be to hold environmental water owned by the South Australian Government and to source additional environmental water in the most cost effective manner, given available State and Federal funding and the opportunities for philanthropy. This Trust should be a holding Trust and should negotiate with the NRM Board for the River Murray, State agencies, Commonwealth Department of Environment and Heritage, indigenous interests and the Murray-Darling Basin Commission, to make water available for this use. The agencies' role is to identify key ecological assets that need to be protected. They need to work with the freshwater ecology community to develop understanding of the watering requirements of each asset. The Trust and the Environmental Manager for the Murray-Darling need to report annually on its activities, including its releases, any trading of environmental water and the state of the environmental assets.

**Recommendation 4**
*South Australia should create a River Murray Environmental Water Trust to hold environmental water in South Australia, to seek additional water using whatever State, Federal or other funding may be available and to seek philanthropic donations of money or water, and to work with NRM Boards to deliver water to protect specific agreed environmental assets. The Trust needs to work closely with an environmental manager, responsible to the Murray Darling Basin Ministerial Council.*

Activities by the Murray-Darling Basin Ministerial Council to date have identified three environmental assets in South Australia:

- The Chowilla Floodplain (including Lindsay-Wallpolla) an area of 17,700 hectares, that is one of the last remaining parts of the lower Murray floodplain that has not been used for irrigation and retains much of the area's natural character and attributes. It has been designated a Ramsar wetland, but requires careful management of its floodplain vegetation.
- The Murray Mouth, Coorong and Lower Lakes, covering an area of about 140,000 hectares are nationally significant wetland areas, also recognised as being of international importance under the Ramsar Convention.
- The River Murray Channel holds iconic status and is the 'main artery' of the River Murray System, forming the link between forest, floodplain, wetland and estuarine assets. It provides in-stream habitat for many aquatic plants and animals, including the Murray Cod and other threatened species (eg trout cod, Murray hardyhead). Its banks support River Red Gum forests, which have strong natural and cultural values.

It is likely that future water planning, especially as indigenous interests are engaged, will identify further important ecological assets for the State.

The next step is to develop the best possible understanding of the watering needs of the assets so far identified, so that the available environmental water is used to the best effect. It is critical to have this information to ensure harmonisation with the use of environmental water for upstream environmental assets.

Our understanding of Lake Alexandrina, the Coorong and what the Lower Murray system needs to be sustained over time, is rudimentary. South Australia needs to work with the Murray-Darling Basin Commission, Federal Department of Environment and Heritage and the CSIRO Flagships program to build upon the hydrological and sediment transport models already under development. It is necessary to undertake a comprehensive ecological study of the Lower Murray system in order to inform water management regarding the needs of this icon site and the ecological trajectories that will arise, if various alternative management options were to be put in place. The State needs to understand the extent to which these systems contribute to tourism and recreational income and the general well-being of people living in this region.

**Recommendation 5**
*The South Australian Government should undertake a comprehensive ecological study of Lake Alexandrina the Coorong, Lower River and Murray Mouth to inform management about the needs of this important environmental asset and ensure it can be managed effectively. This will require a three-to-five year study and should identify future trajectories of the ecological assets, under different salinity regimes and during wet and dry periods. The study would benefit by engaging indigenous knowledge of the Coorong and how it functions.*

Given the recognition that the channel of the Murray system is an important ecological asset, it is important to use the best available ecological advice to manage the river. It is also important to develop knowledge about how to manage the various weir pools along the Murray, in order to enhance the ecological outcomes. Fluctuations in river height are thought to be important drivers of the river ecology. This has been identified as a priority action in the Draft South Australian River Murray Flow Management Strategy. Some preliminary trials have been undertaken, but more work is needed to understand what is possible and desirable. This involves not only raising water levels to connect wetlands with the river, but also dropping levels to enable drying of riverbanks. Both of these fluctuations may cause concern with the community who have been accustomed to static water levels. There are also some difficult issues with salt inflow and bank slumping that require cautious and careful management. The community should be involved in the necessary decision-making processes.

**Recommendation 6**
*The South Australian Government should continue to explore the ecological benefits of raising and lowering water level in weir pools of the River Murray, working with the community to explore what can be done in this regard to improve the health of the river.*

## 2.9 Strengthening the Murray-Darling Basin Commission

The Murray-Darling Basin Commission has always been a critical forum for South Australia to be able to negotiate with upstream States about management of the Murray as a whole system. The Murray-Darling Basin Commission is now at a crossroads, with some players seeking a minimalist Commission rather than one that takes an active role in pushing States towards improved water management.

There is a rapid turnover of Commissioners and now few of them have substantive technical skills in water management, with most coming from a policy or management background. Whilst it is desirable that all jurisdictions correct this situation, South Australia could go it alone and lead in this endeavor. South Australia should also seek to strengthen the technical expertise contributed to all levels of Commission activity, in order to provide substantive leadership to address key issues, rather than just protect the States' interests.

**Recommendation 7**
*South Australia should appoint one of its Murray-Darling Basin Commissioners to speak from a whole-of-government perspective. The second Commissioner position should be used as an opportunity to appoint an expert in a relevant area, with a five-year term, to provide some substantive knowledge amongst Commissioners and to ensure some stability that has not been attainable with the frequent changes of heads of agencies.*

# 3. Water for Adelaide

Adelaide is a vibrant and exciting city of over one million people, widely regarded as one of Australia's most liveable cities. Water is crucial to the sustainability of the city, and is an issue of considerable interest to the residents. Adelaide has hot dry summers, with the lowest annual rainfall of any Australian capital.

## 3.1 The Use of Water

In 2002-3 SA Water supplied 178 GL of water to 475,000 properties, serving a population of 1.08 million people in metropolitan Adelaide (WSAA Facts 2003). SA Water supplies around ninety percent of the State's population with water. Obviously, the amounts of water used each year vary, depending mainly on climatic conditions and recent usage is shown in Table 5.

Over the last five years the Adelaide metropolitan area used 182 GL of water a year, with an average per capita consumption of 172 KL/capita/yr. The non-metropolitan communities supplied by SA Water use an additional 92 GL per year to supply 415,000 people over this period.

There are many factors that influence the water used by a city, including climatic patterns, the form of urban development and the habits of the users. Adelaide has a low population density with 2.4 people/property, compared to 2.6 for Melbourne and Perth and 2.8 for Sydney. Adelaide supplies less water to industry than other cities, with seventy-five percent of the total water used going to residential properties (compared to sixty-seven percent Perth, sixty-one percent Sydney, fifty-three percent Melbourne).

Table 6 shows some comparative water usages for several Australian cities, showing the usage per residential property and per capita. The ABS Water Accounts 2003 show the distribution of water use between indoor and outdoor uses and this is also used in Table 6. The Perth figure may be understated due to the presence of over 100,000 un-metered domestic bores.

In 2003, people in Adelaide used more water per residential property than in the other cities shown. They also use more than others both indoors and outdoors. The lower percentage of water used outdoors in Melbourne and Sydney reflects both rainfall patterns and the greater proportion of the population living in apartments with no gardens.

Adelaide is a city with lots of public and private gardens, which shows in the proportion of water used outdoors. The rainfall patterns each year are obviously important in explaining these differences, but it would seem that Adelaide is a relatively high water consumptive city, due to the consumption of the urban residential sector.

**Table 5**
**Adelaide and Country Town Water Use 1998-2003**
(Source – WSAA Facts 2003).

| Year | Rainfall | Metro Population Served [1] | Total Metro water Use | Non Metro Use |
|---|---|---|---|---|
| | mm | Million | GL | GL |
| 1998-9 | 578 | 1.045 | 184 | 85 |
| 1999-2000 | 677 | 1.050 | 186 | 85 |
| 2000-1 | 594 | 1.053 | 194 | 94 |
| 2001-2 | 591 | 1.064 | 173 | 93 |
| 2002-3 | 530 | 1.077 | 178 | 103 |
| **Mean** | **594** [2] | | **182** | **92** |

[1] These figures relate to the overall supply to the metropolitan area and includes industry and other uses besides direct household consumption.

[2] This is the mean for these five years. The long-term mean is 530mm.

**Table 6**
**Comparative Residential Water Usage, Selected Australian Cities, 2003.**
(Source – WSAA Facts, 2003)

| | Rainfall | KL/ Residential | KL/capita | % used | KL /hd water |
|---|---|---|---|---|---|
| | mm | Property | | outdoors | used outdoors |
| Adelaide | 530 [1] | 295 | 124 | 50 | 62 |
| Melbourne | 351 | 217 | 84 | 35 | 29 |
| Sydney | 1001 | 255 | 92 | 25 | 23 |
| Perth | 747 | 260 | 101 | 50 | 50 |

[1] The year 2000-2001 was drier than previous years as is shown in Table 5, but reflects the long-term rainfall. This year was very dry for Melbourne, a little below the mean in Sydney and Perth. Care is required in comparing figures for a single year.

## 3.2 Sources of Water

Adelaide takes its mains water from two sources, the Hills catchments and the River Murray. The relative importance varies, depending on climatic conditions, but over the last five years the average has been fifty percent from the Hills catchments. In a dry year like 2002, only 62 GL, or thirty-five percent of the metropolitan supply, comes from the Hills catchments. There is a five-year rolling cap on what can be extracted from the Murray, although this can be increased if SA Water purchases water from irrigators, which it has been doing recently.

Some forty-nine percent of South Australian households have domestic rainwater tanks, by far the highest proportion in the country but these probably provide no more that 1 GL. A further twenty percent of the water used in the Adelaide region is groundwater, used mainly for irrigation of urban amenity plantings, playing fields, lawns or for agriculture (Waterproofing Adelaide 2004). Adelaide also recycles some 17 GL of treated water, used mainly for agriculture.

**Table 7**
**Sources of Water Used in Adelaide Region, GL**
(Source – Waterproofing Adelaide, 2004)

| | |
|---|---|
| Mains Water | 200 |
| Groundwater | 51 |
| Rainwater tanks | 1 |
| Recycled water | 16 |
| Urban Stormwater (ASR) | 2-3 |

South Australia has pioneered the use of Aquifer Storage and Recovery (ASR) to store urban runoff so that it can be used when needed. This involves storing stormwater in wetlands and pumping it down into confined aquifers for storage but so far only about 2-3 GL is stored and used in this way.

## 3.3 The Squeeze on Water

The Government's State Strategic Plan includes a population target of two million for South Australia by 2050. They will mostly live in Adelaide and will certainly be dependent on water taken from the Hills catchments and from the River Murray. If the community still uses water in the present way, this will take domestic demand from 274 GL per year to around 367 GL per year. If all of these new people use water as metropolitan residents currently do, the demand will be 344 GL/yr.

The challenge for Adelaide is to understand where this water might come from and what are the risks associated with the various possible sources. There is a widely held assumption that the water needed will be taken from the River Murray. Successive governments have apparently also taken this view, since little attempt has been made to protect the Hills catchments as a water supply to Adelaide, although some good work was done on this in the late eighties and early nineties. The yield of these catchments now appears to be dropping, due to farm dams and bores.

This assumption is worth re-examining, given the following possibilities:

- While the National Water Initiative contains an agreement to establish a national water market that will allow urban communities to purchase water from irrigators, interstate trade has not as yet been agreed between the States.
- Rural communities will exert considerable political pressure to avoid transferring wealth from their communities to support a city, especially a city that is seen as quite wasteful in its use of water. This concern from rural communities is already obvious in South Australia where irrigation water has been purchased for urban use.
- The climate change suggestions may mean there is significantly less water available in the River Murray and the competition for it will become more intense.
- South Australia has been concerned about the state of the Murray mouth and may have to find a share of the increased water required for environmental flows.
- The likelihood of increasing salinity in the River Murray and the possibility that there will be significant periods when it is outside World Health Organizations desirable drinking water guidelines.

If we consider another average year like 2002-3 and an increased demand of, say, 370 GL, then the following situation might arise. These are rough estimates and the assumptions can be varied, but they show an increasing reliance on the River Murray to sustain the city of Adelaide.

The stark situation is that Adelaide is facing a squeeze on its available water. It would be prudent for the State to consider how it will meet this demand, especially if additional water is either not available from the River Murray, or more likely, is excessively saline for domestic use. Contingency planning should be underway for a situation when the River Murray cannot sustain the city.

**Table 8**
**Indicative Future Water Supplies GL**

| | Current 2002-3 | Future | Future % | |
|---|---|---|---|---|
| Total | 281 | 370 | 100 | |
| Water from Hills catchments | 62 | 50 | 13.5% | Reduced yield due to development |
| Water from Domestic Tanks | 1 | 6 | 1.6% | Possible impact of new houses having tanks |
| Water from the River Murray | 218 | 314 | 85% | Assumes purchase from irrigators and that water is useable |

There are four strategies available to manage the water supply to the city and, at this stage, all of them should be undertaken:

- use demand management approaches to reduce per capita water usage,
- protect the Hills catchments to try to maintain water quality and quantity
- address the salinity issues in the South Australian section of the River Murray, as outlined in the previous section on the river
- develop alternative sources of water, including recycling, stormwater and desalination.

## 3.4 Managing the Demand for Water

Table 9 shows per capita water use based on residential water supplied and the populations for each year shown in WSAA Facts 2003. This table removes the effects of population growth, but comparison between cities is still difficult, due to rainfall amounts and patterns and on the base year that is chosen. In Table 9 the base year chosen is 1997-98 and the change over the five-year period is shown.

Some State Governments have required water utilities to undertake water conservation campaigns to reduce water usage, with some States having had some considerable success with this. SA Water has undertaken a water conservation campaign only since 2002 and, as yet, no useful effect can be seen.

It might be worthwhile having a third party undertake an audit of the water conservation strategies SA Water has put in place and the level of resourcing, comparing that to the efforts of the other cities.

South Australia has, along with other jurisdictions, now committed under the National Water Initiative to:

- introduce the mandatory Water Efficiency Labelling Scheme for agreed water using domestic appliances
- develop and implement a 'Smart Water Mark' for household gardens, including garden irrigation equipment, garden designs and plans
- review the effectiveness of temporary water restrictions and public education strategies. Assess the scope for extending low level restrictions as standard practice
- address system losses
- review the water reuse guidelines and incentives for water-sensitive urban developments.

Since more residential water is used outdoors in Adelaide than in the other cities (Table 6), there are real opportunities for saving here through more efficient watering practices and substitution with recycled water or urban stormwater. All local councils should be charged for water, to encourage less use in urban parks, to encourage use of recycled water and stormwater and to encourage at least some of the city landscape to use native grasses and native gardens.

Adelaide is not at this stage experiencing rapid population growth, so does not have the extensive greenfields developments of some other cities. Nevertheless, it is important to ensure that both new greenfield developments, and any redevelopments of established urban areas, are water-sensitive urban developments.

**Table 9**
**Changes in per capita water usage 1997-2003 (Kl/capita/yr)**
(Source – Derived from Residential water supplied and populations from WSAA Facts, 2003)

| | 97-98 | 98-99 | 99-00 | 00-01 | 01-02 | 02-03 | Change |
|---|---|---|---|---|---|---|---|
| Adelaide | 100 | 108 | 110 | 114 | 106 | 124 | +24% |
| Brisbane | 136 | 113 | 92 | 110 | 110 | 106 | -22% |
| Canberra | 116 | 105 | 101 | 107 | 99 | 106 | -9% |
| Melbourne | 90 | 86 | 89 | 90 | 81 | 84 | -7% |
| Perth | 126 | 113 | 121 | 128 | 111 | 101 | -20% |
| Sydney | 90 | 85 | 87 | 91 | 90 | 92 | +2% |

There is a need to get the water utility, the planning department and the various regulators of health and environmental aspects, to work together to ensure water sensitive urban developments are encouraged. This is not seen as the case at present. The new requirements for domestic tanks are a good start but more can be done. New South Wales has recently committed to a forty percent reduction in household water use in new developments while Victoria is seeking a twenty-five percent reduction. These jurisdictions are not specifying how this should be done, but are seeking to stimulate innovation to achieve these outcomes.

South Australia needs a much more effective effort to reduce the urban demand for water. There is a challenge in expecting SA Water to lead such an effort, since they are a commercial body charged with selling water and expected to provide a return to government. Some States have required the utility to reduce demand through the operating licence; another approach is to have the Minister for Environment jointly responsible for the utility to ensure sustainable water use is given an appropriate priority.

**Recommendation 8**
*SA Water should be required initially to stabilize per capita consumption within three years, and then to reduce it by ten percent within ten years. Consideration should be given to having SA Water responsible to the Minister for Environment and Conservation, as well as the Minister for Administrative Services, to ensure sustainable water use is given equal status with generating revenue.*

*The Government should encourage water-sensitive urban developments in new areas and in major redevelopments by a range of measures including zoning, subsidy and development charges. The Government should develop a single whole-of-government water conservation program rather than have several competing programs.*

## 3.5 The Future of the Hills Catchments

Over the last five years some fifty percent of the water used in Adelaide comes from the Hills catchments, yet the quantity and quality of this water is at risk, due to failure to plan and manage these catchments effectively. The yield from the catchments has already dropped, due to the increase in farm dams on hobby farms and larger enterprises such as vineyards. The water quality is at serious risk from agricultural activities, especially the widespread use of pesticides and herbicides in the catchment. The Mt Lofty Watershed Protection Office estimates forty-four percent of the septic tanks in catchments are not working effectively. Regular inspections and pump outs are one way to treat this problem.

Government needs to develop and articulate a clear vision for the Hills catchments, as had been intended in the Mount Lofty Ranges Review in the 1990s. Are they to remain an integral part of Adelaide's water supply system? If so, they need to be well managed, or are they to be the location for new urban communities and hobby farmers? There are significant risks to water supply unless the catchments are managed better. It would be imprudent of South Australia not to protect the Hills catchments and manage them to achieve a better water supply for Adelaide. The following actions are required:

- prevent further subdivision, causing more hobby farms and closer settlement
- explore planning controls on agricultural activities to prevent the situation getting even worse
- proclaim the catchments and prevent more farm dams and bores taking water
- instigate an effective and integrated water quality monitoring program to measure the catchment management performance
- expand the work of the Mt Lofty Watershed Protection Office to ensure compliance with pollution controls in the catchments.

There is an opportunity here to show national leadership. The citizens of Adelaide expect those living in the Hills to provide them with adequate quantities of high quality water. The tension between the economic interests of upstream and downstream communities is not confined to how other States manage water; the same problem is evident here. Could the urban water users pay rural landholders who provide the city with water for these ecosystem services? If landholders with high quality native vegetation were paid an appropriate sum, say $50 per hectare, those with well managed pasture (not overgrazed and with fenced riparian) were paid, say $25 per hectare and those with cultivation adding sediment to streams charged, say $50 per hectare, there would be a marked improvement in catchment management. The actual amounts need to be determined by looking at the cost to the farmers to make the arrangement an attractive one to them.

**Recommendation 9**

*The Government should take the following actions to protect the Hills catchment:*

- *Proclaim the catchments under the water resource provisions of the new Natural Resources Management Act to control farm dams and bores from extracting more water from the catchment.*
- *Require metering for all commercial extractions from surface or groundwater.*
- *Demand effective land use planning that prevents further urban development in the catchments and insist on the appropriate infrastructure to deal with sewage.*
- *Strengthen the Mt Lofty Watershed Protection Office and let it expand its programs to assure compliance with pollution control requirements.*
- *Pay landholders who contribute good quality water for the ecosystem services they provide to the community; charge those who contaminate waterways.*

## 3.6 Recycled Water

The Waterproofing Adelaide study has been stimulating community discussion about some alternative supplies of water. There is abundant recycled water available from the sewage treatment plants of Adelaide. This can be used to reduce the demands on potable water if it is made available for appropriate uses in industry, garden watering and perhaps toilet flushing (Radcliffe, 2004). We do have the technologies available to treat such water to the level that it could be added directly to potable water storages, but this is not necessary at this stage.

What is needed, is to start using recycled water to replace the use of potable water, not to further expand commercial irrigation with this valuable resource. Adelaide has already achieved about twenty percent recycling of its treated effluent, which is taking pressure off the sea grass beds in the coastal waters that would have been affected by this discharge of effluent. However, the recycling agenda now needs to move forward and start replacing potable water use.

If this agenda is to be advanced, the whole urban strategy of large trunk sewers going to central treatment works on the coast needs to be reexamined and replaced with smaller sewage treatment works further up in the urban catchments, allowing gravity distribution of recycled water. Many jurisdictions are now learning about third pipe systems where recycled water is delivered to domestic blocks for garden watering and toilet flushing. Adelaide has one example of such a development at Mawsons Lakes, but more

developments are needed if we are to learn how to use such approaches in a cost-effective way. There are also possibilities for using recycled water to irrigate open space around Adelaide.

**Recommendation 10**
*SA Water should be encouraged to use recycled water as a replacement for potable water in appropriate uses and should work with the development industry to encourage this in new developments and redevelopments.*

## 3.7 Urban Stormwater

Urban stormwater is another significant possible source of water. The difficulty with urban stormwater is that it must be trapped and stored until it is needed in drier periods. Many jurisdictions use wetlands for this and Adelaide has some good examples of urban wetlands. However, due to innovative research from CSIRO, Adelaide leads the country and is at the international forefront in aquifer storage and recovery, where stormwater is pumped into aquifers and later recovered for a variety of uses. The Salisbury Council has been at the forefront of developing and demonstrating this approach. At present about 2-3 GL of stormwater is stored and used in this way, but the potential to trap a significant volume, perhaps up to 40 GL exists and needs to be actively developed. The Government has a taskforce on urban stormwater and hopefully, they will clarify issues relating to responsibility for stormwater, which must be on a catchment basis, ownership, liability and so on. The regulatory framework also needs to be examined to ensure that this innovative technology is developed and not stifled by inappropriate regulation.

**Recommendation 11**
*The Government should clarify the control and responsibility for stormwater and encourage its use as a commercial resource, as water supply for appropriate uses. A roundtable conference between the environmental regulator, the health regulator and the relevant research community should negotiate an appropriate regulatory environment that encourages the development of aquifer storage and recovery, as well as a pricing and management regime to protect groundwater.*

## 3.8 Desalination

Seawater and saline groundwater provide huge reserves of water that could be available if we develop cost-effective desalination technologies. Many believe that is not a case of if, but a case of when, for desalination and South Australia has already developed some pilot plants.

The environmental challenges of desalination relate to the energy use and greenhouse gas emissions, entitlement to a common property resource, the impact on the natural environment of point source withdrawal of seawater, and the potential disposal of highly saline brines. The other major impact is that of inducing growth in areas that have been previously restricted, due to the lack of water.

Desalination is an area where technological development can be expected and it is certain the costs will come down. Perth is seriously considering desalination for the city water supply.

South Australia frequently gets proposals for innovative desalination plants, some using solar energy. There are possibilities for South Australia to take a leadership role in this area.

**Recommendation 12**
*The Government should develop a State policy towards desalination that addresses planning issues, access to saline water, disposal of brine and management of other environmental impacts. The support the Government may provide to appropriate proposals could be outlined to encourage innovation in this area.*

# 4. Appropriate Pricing

## 4.1 The Price of Water

In our society we allocate scarce resources on the basis of price. We know that when we underprice a resource, people do not care about waste. This has been one of the tragedies of our irrigation developments over the last eighty years, only now being redressed as we develop a water market. Some believe that as rain falls from the sky there should be no charge for water, but governments have charged the costs of collecting, storing, treating and delivering water to consumers.

In 2003 SA Water charged an access charge of $130 to connect to the system and 40$^{c}$ for the first 125KL of water and thereafter 97 cents, with a slight increase in 2004. A sewerage charge based on property value is also charged, with a minimum of $241. These water charges are uniform across the State. On top of this, many property owners pay a levy to their Catchment Management Board and the River Murray Levy. This sort of stepped charge for consumption ensures low-income users have a basic allocation of water at a low price, but means that higher users pay significantly more.

To compare water charges, WSAA provides information on an average 250 KL per annum consumption.

**Table 10**
**Comparative Water and Sewerage Charges**
based on 250KL/yr av consumption
(Source – WSAA Facts, 2003)

| | |
|---|---|
| Adelaide | $ 665 |
| Brisbane | $ 620 |
| Canberra | $ 595 |
| Melbourne | $ 497 |
| | $ 505 |
| | $ 504 |
| Sydney | $ 638 |
| Perth | $ 695 |

## 4.2 Water Pricing Commitments under the National Water Initiative

The National Water Initiative of 2004 has committed the State to implement water pricing that promotes economically efficient and sustainable use of water resources, of the water infrastructure assets and the government resources devoted to the management of water.

South Australia should now introduce an Independent Price Regulator to establish appropriate prices for urban and rural water. This goes beyond the current arrangement, where the Essential Services Commission is required to review the transparency of pricing decisions.

The following principles have been agreed to guide the Price Regulator:

- Water prices must be based on actual water consumption, so all surface and groundwater extractions of water must be metered and pricing shall be on a volumetric basis.
- Full cost recovery where feasible and practical. Where this is not feasible, any subsidy should be transparent.
- Pricing to include the costs of environmental externalities.
- Pricing to include government costs for managing the water resource, including the costs of managing a water market.
- Development of pricing policies for recycled water and stormwater that are congruent with pricing policies for potable water, and stimulate efficient water use.
- Review of trade waste pricing policies to facilitate recycling.

The National Water Initiative also establishes some specific reporting requirements that will help influence the behaviour of water users:

- Customers' water accounts to provide information on water use, relative to equivalent households.
- Public reporting of the cost of water planning and management.
- Independent benchmarking of pricing and service quality for all water delivery agencies, urban and rural.

**Recommendation 13**
*The South Australian Government should establish an Independent Price Regulator to review and establish appropriate urban and rural water prices in South Australia. The National Water Initiative provides an excellent framework for implementing this without delay.*

## 4.3 Environmental Externalities

Best practice water pricing requires a charge for externalities, as was agreed under the 1994 CoAG Agreement, but has not been widely implemented. When we extract water from a river or aquifer and when we apply it to land, we commonly cause damage to the environment. The idea of charging for externalities is to ensure the environment is not providing a free subsidy to water users, by underwriting some of the costs of their operations and to provide a stream of funding for environmental repair works.

In practice, it has been difficult to work out what is an appropriate price for such externalities. One approach implemented by the Victorian Government in its recent White Paper on Water, is to charge all urban water delivery agencies a flat charge of five percent of all revenue, and rural agencies two percent. This seems a workable approach to this problem and is worthy of consideration.

## 4.4 Uniform Pricing Across the State

South Australians pay a uniform charge of around a dollar per kilolitre of water, wherever they are and whatever it costs to supply them. In some remote places it probably costs $4/KL to supply, although the actual costs of supply are not transparent.

This pricing strategy provides for social equity for the more remote communities and probably does not impose a large cost-burden on other water users. Nevertheless, under the 1994 CoAG Agreements, such subsidy should be transparent.

This pricing strategy also inhibits innovation. Some of these remote communities might be better served by more innovative water supply options including desalination and recycling. At present these alternatives tend to cost more than the water supplied from the main Adelaide supply and therefore, cannot compete with the subsidised product.

Given that the Government has been keen to promote an innovative water sector and to exploit the export potential of its water industry, through the Water Industry Alliance and its investments in water research, it is perverse to have such barriers to innovation.

**Recommendation 14**
*The Government should consider putting the water supply of remote communities out to tender to foster innovation and development of the most cost effective approach to water supply for these communities. Any cross-subsidy needs to be transparent.*

# 5. Regional Bodies and Natural Resource Management



Natural resource management seeks to provide a range of outcomes:

- management of soil, vegetation and water to avoid the degradation of these resources
- agricultural production leading to vibrant rural communities
- maintaining genetic pool through biodiversity conservation
- providing ecosystem services that includes climate regulation, water regulation, nutrient cycling waste treatment and biological control of pests.

Private landholders manage most of the Australian landscape. These people have particular attachments to the country they manage, but many are constrained in what they can do, given the vagaries of climate and agricultural markets. The last twenty years has seen a growing realization that land and water cannot be managed effectively at the scale of the individual property. Communities need to work together if they are to address many of the problems of soil degradation, water quality and pest invasion.

Agriculture contributes $28 billion to the Australian economy and is significant to our export income. However, there has long been concern that some of our farming practices cause impacts on downstream communities and the natural environment and, that the costs of this degradation are not factored in to the decision-making framework of landholders.

The growing realisation that the environmental impacts of farming were also reducing the profitability of farming-led to the development of Landcare, as a "self help" approach that assisted landholders to work together to address local problems that had to be addressed on a regional basis. The success of Landcare made it apparent to governments that local groups, who recognised and took responsibility for the impacts of managing land, was an effective way of managing much of the Australian landscape in a more sustainable way.

This model of bringing together local people with a shared interest in natural resource outcomes, developed in Landcare, has now developed further with governments assisting the forming of regional catchment groups. These regional groups are the means by which much of the Federal and State Government investment in natural resource outcomes are achieved.

## 5.1 Development of Regional Models of Delivery in South Australia

The South Australian Government established a series of Catchment Water Management Boards under the Water Resources Act of 1997. This followed the earlier establishment of Catchment Management Authorities in Victoria. These two States have led the way in establishing substantial regional bodies to manage natural resources. Generally, the Catchment Water Management Boards have been partially funded by a catchment levy on landholders and fees from licensed water users, with considerable success and strong community support.

South Australia is now building on this experience and is establishing a series of Natural Resource Management Boards in 2004 bringing water management, soil erosion control and pest control together under a single regional board.

The new Natural Resource Management regions are larger than many of the original Water Board regions, but will link directly with federal funding of natural resource issues. The regional model requires local communities to work to understand their resources, the threats and opportunities and the aspirations of their communities. They are required to consult widely and to develop a regional plan that focuses energy and investment on the priority issues. State and Federal Governments accredit the plan and then invest to achieve specified outcomes. The two major programs are the Federal-State National Action Plan for Salinity and Water Quality and the Federal Natural Heritage Trust program. Both of these operate on the same basic planning-delivery model. The five NAP regions have already submitted and had accredited both their regional plans and their Investment Plans and the three NHT regions are still finalising this documentation, as at July 2004.

To make this regional model work effectively, it is fundamental that the State articulates what are the State interests and State investments in every plan and insist that the community planning deliver these elements. There may be specific sites that have been designated as national parks, Ramsar sites or be known to contain ecological communities of particular interest. Determining the required wetting regimes and water quality for these sites may be more difficult, but is an obligation of government. Governments may also set end of valley targets for water quality, salinity, streamflow and biodiversity. Accredited plans need to be built on sound science and identify the appropriate actions to deliver on these targets in each catchment allocating resources so key targets are achieved.

## 5.2 Emerging Lessons from the Regional Model

There is now enough experience with the regional model, to encourage us that it is an important way of delivering natural resource outcomes. The model achieves this by building regional capacity to empower landholders to understand their resource and how the use of it affects others. It is important for government agencies to ensure that regional boards are supported, as the on-ground delivery arm of government and not seen by agencies as competitors for influence and funds.

A number of difficulties have become apparent with the model that can be addressed by governments:

- There is a tendency to focus on the short-term interests of locals, rather than longer-term issues or the interests of those downstream.
- Regional communities feel they get little guidance from governments and get different and at times, conflicting advice from different agencies.
- There is a need for a national system of monitoring and evaluation, rather than self-monitoring.
- Regional communities are concerned about short-term funding, which makes staffing difficult, as well as the high administrative costs imposed by reporting requirements.
- Regional communities have limited capacity in terms of both skills and time to get engaged often finding the planning processes complex and inflexible.

There are opportunities for the State to provide the Natural Resource Management Boards with appropriate support. State agencies need to work together in a whole-of-government approach and see the NRM Boards as the delivery mechanism for State programs, not as competitors. State agencies need to help NRM Boards focus on the most important issues and ensure they take into consideration longer-term issues, the State interests and the interests of downstream communities.

**Recommendation 15**
*State agencies need to work together to support the NRM Boards with resources and appropriate knowledge, and should clearly articulate the wider State interest that must be incorporated into plans.*

## 5.3 Ensuring Regional Bodies have the Appropriate Knowledge

Regional bodies need to work with three clusters of knowledge. These are local knowledge, scientific knowledge and indigenous knowledge – accessing these clusters is difficult.

Local knowledge is firmly held in regional communities and is well represented in regional bodies. It often focuses on shorter-term issues and aspects of production, regional wealth and well-being. Droughts and floods are quickly forgotten or discounted as unusual events. It is local knowledge that has created many of the current problems.

Scientific knowledge may be difficult for communities to access and use. The material may be complex and may introduce a real tension with the local knowledge. Certainly, many scientists believe the best scientific knowledge is often not reflected in regional plans and that regional bodies don't put in enough effort to understand what is already known.

Indigenous knowledge is also hard to access and to understand, but there is much to be learned in listening to the stories of indigenous elders. There are already a few examples where this has been incorporated into regional plans.

The State needs to work with the regional bodies and the Federal Government to ensure the appropriate knowledge needed, to set and achieve outcomes, is available and accessible to the regional bodies. State and Federal Governments should demand a good connection between the plans and the existing knowledge base as an element in accreditation.

To ensure that necessary research is identified and undertaken, the South Australian Government has established a Centre for Natural Resources to act as a broker between the regional bodies and the research community, to help ensure necessary research is undertaken.

- Help package appropriate knowledge in forms that are useful to NRM Boards, around key issues such as salinity, environmental flows, river restoration and biodiversity.
- Understand the importance of capacity building as a learning process that is driven by the community, rather than the knowledge providers and ensure appropriate access to knowledge, as sought by the community.
- Ensure resources to boards are adequate to enable some in-house staff to be part of the planning team so that some learning stays in the community, rather than simply benefits consultants.

**Recommendation 16**
*The Centre for Natural Resources should identify appropriate research expertise for various issues within the State and elsewhere, and develop a knowledge strategy for regional bodies that identifies knowledge gaps and make these known to the research community, as well as make specific investment in priority areas.*

## 5.4 Building Regional Capacity

One value of government investment in regional natural resource management, is that it provides a way of building regional capacity so that communities are more able to cope with new and emerging issues as they arise.

This idea means we need to think about regional natural resource management as a co-learning model. It is obvious that the community groups do need to learn from the technical support people in government, the scientific community and from consultants. But it also apparent that these technical people need to learn from the community as to what are workable solutions and what still needs more research.

This co-learning model means that planning is at least as important as producing a plan and may need more time than it has been given. Researchers and consultants are important to help the process, but they must work with local staff that will stay in the community and retain some of the learning. This is a new approach that is based around providing knowledge when the community is ready for it and on the community's terms.

Those involved in community groups often learn as much from each other as from technical experts, so the State Government should consider establishing "communities of practice" of those with an interest in a particular area, bringing them together along with relevant experts to build the capacity and understanding of all. These need to be focused on issues of concern such as salinity, biodiversity, river restoration and water use efficiency. These should be brought together say three times a year to share how the different boards are approaching various issues, providing a strong connection with the research base.

**Recommendation 17**
*The Department of Water, Land and Biodiversity should facilitate and support "communities of practice" of key people from each Natural Resources Management Board and the technical community, to meet three times a year to share information and experiences in the specific areas of interest.*

## 5.5 Monitoring and Evaluation

Feedback on the outcomes being achieved, is fundamental to the regional bodies focusing and investment. It is also critical for governments who are investing to achieve natural resource outcomes. The health of waterways is an excellent indicator of catchment health and should be a core element in monitoring, although there will be other elements as well.

In South Australia there a number of disconnected water quality and river health monitoring programs. Much more could be achieved from current investments if these were integrated and undertaken at a high professional standard.

It is not enough to leave this to the Natural Resources Management Boards, since this is little more than self-reporting. The State needs to design and implement a professional monitoring program to monitor stream flow, river health, groundwater depth and quality and selected other elements. This should be designed to meet the needs of managers in agencies and the boards, and for regulators. The results need to be publicly reported on the Web. There should be a requirement to produce periodic interpretations of these data so that data are converted into knowledge, in a way that is often not done at present.

**Recommendation 18**
*The State needs to implement an integrated water assessment program that provides data on streamflow, water quality, river health groundwater depth and quality. These data need to meet the needs of a range of data users, and should be publicly available. Periodic interpretative reports should be made available, perhaps through State of the Environment reporting.*

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