NSW Water Conservation Strategy

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FOREWORD

Water is a valuable and scarce resource. The competing demand for water from various users is placing a strain on New South Wales's limited water resources. The responsibility for water conservation rests with us all.

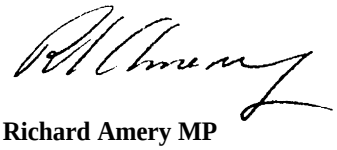
The New South Wales Government is introducing measures that promote the efficient use of water and its conservation by all water users. Importantly, the strategy focuses on the government's view that we all have to work in partnership to achieve the sustainable management of water resources.

The Water Conservation Strategy takes a holistic approach to water use efficiency and conservation. The strategy builds on existing programs and projects, and addresses both urban and regional environments and the way in which it is used throughout New South Wales. The strategy aims to achieve a broader awareness and commitment to water conservation and a greater recognition of the scarcity and value of water in our society. We have offered a vision, and identified principles for water conservation and nineteen strategies and associated specific actions which will be undertaken by the government and the community of water users.

The strategy is the result of extensive public consultation and contributions from the Water Conservation Task Force. This task force consisted of an independent chair and representatives from various non-government and government organisations including the NSW Irrigators Council, the Australian Water Association and the Nature Conservation Council.

Every three years I will be reporting to the New South Wales Parliament and the community on the progress achieved in implementing the strategy.

The New South Wales Government needs your personal support to achieve a more responsible use of water in our state. I urge everyone to support the implementation of the strategy.



Richard Amery MP
Minister for Agriculture
Minister for Land and Water Conservation

EXECUTIVE SUMMARY

THE STRATEGY

The New South Wales Water Conservation Task Force reviewed water availability in New South Wales, the regulatory framework and the way water is being used in each sector compared with 'best practice' water management within the constraints of existing information. Current projects and programs were reviewed by sector, and the constraints to improving water use efficiency were analysed.

There is no single answer to solving the problem of competing demands for water in New South Wales. The major demands are from cities and the irrigation industry, and the increasing needs of these users in times of drought and low river flow mean that few options are available for additional users or to provide environmental flows. There are finite limits to the total quantity of water that is reliably available and the costs in both monetary and environmental terms of developing and enhancing water sources are prohibitive.

In the light of these circumstances, New South Wales must take a comprehensive approach to water conservation. The Water Conservation Strategy contains 19 strategies and 55 actions which will promote significant improvements in water conservation in New South Wales.

The strategies range from research to education, from financial incentives to water-efficient appliances and include aspects of water management and use that require direction, support or initiation. Action needs to be taken by all groups involved in water use in New South Wales – local and State Government, industry organisations, householders, and professional organisations. Whilst it is envisaged that the Government will provide leadership, the responsibility for water conservation rests with the whole community.

Opportunities for and benefits of water conservation are greatest for irrigated agriculture as the largest user of water.

In urban areas, encouraging the use of water-efficient appliances and equipment including, for example, shower heads and washing machines will yield the best long-term water conservation rewards.

Water conservation is so fundamental to living on a continent with the great climatic variability of Australia that there is a need to educate the whole community on the responsible allocation of water (to meet the needs of both the community and the environment) as well as on the impact of water use. However, sometimes this community education imperative is neglected. It is essential that water education programs be revitalised and carefully targeted.

Responsible water conservation also requires knowledge of the most appropriate action to be taken and this means there is a need for research. The strategy incorporates actions for further research on issues related to water.

Evaluating the existing use of water, improving efficiencies and encouraging appropriate reuse is still needed in all sectors. Some water audits and resulting improvements undertaken by the New South Wales Government have already shown impressive savings – in both water and dollars. As a sign of community leadership, the strategy proposes that state agencies and local government continue to undertake water audits and implement the savings identified by these audits.

Failure to adopt an effective New South Wales Water Conservation Strategy now will result in harsh consequences. New water sources will have to be found and funded. Otherwise, the environmental, lifestyle and economic benefits which the people of New South Wales currently enjoy will be sacrificed.

The Strategy provides a vision and set of principles, strategies and actions that will build on and guide public and private sector initiatives in the area of water conservation for the foreseeable future. The issue of water conservation is the responsibility of all members of the community. It is, therefore, intended to achieve community-wide involvement in addressing the problems of water conservation throughout NSW.

VISION FOR WATER CONSERVATION

The vision for the conservation of water in New South Wales is:

'People in New South Wales working towards greater efficiency in the use of water in a manner that recognises its true value, is economically viable and environmentally sustainable.'

PRINCIPLES OF WATER CONSERVATION

The following principles have been developed to support the vision for water conservation in New South Wales:

- Water use should be consistent with the principles of ecologically sustainable development.
- Governments (State and Local) should offer leadership in water conservation through policy and by example.
- Water conservation strategies should be adaptive and able to respond to technological, economic, environmental and social change and to differences between catchments and aquifers.
- Water conservation should be promoted and exercised by all users and managers in all water use sectors.
- Water conservation should encompass a comprehensive range of measures and tools, including education, regulation, incentives, pricing, research, water reuse and technological development.
- Water should not be used for a purpose where water of a lower quality could be used more efficiently and economically.
- Water quality should be recognised as a factor which significantly affects the availability of water for various uses.
- Water conservation measures should be focused initially on strategies which will achieve the greatest effect at the least total cost to the community.
- Water conservation measures should not compromise public health or have detrimental impacts on the ecological health of our catchments.

SUMMARY OF STRATEGIES

The strategies to conserve water resources involve:

1. Creating partnerships between the Government and stakeholders to demonstrate and implement a commitment to water conservation in New South Wales.
2. Auditing New South Wales' water resources in order to accommodate beneficial uses more appropriately.
3. Ensuring that decision-making in New South Wales related to water is based on ecologically sustainable development principles.
4. Recognising best practice in water conservation by instituting awards which celebrate and promote achievements in water conservation.
5. Pricing and valuing water according to full cost recovery principles and using it for its highest net value in order to enhance environmental protection.
6. Providing direct financial incentives to encourage water users in all sectors to invest in conserving water and achieving efficiencies.
7. Integrating overarching water conservation principles into policy and legislation review and development.
8. Ensuring that the Government leads by example to implement water use efficiency measures in order to encourage similar practice outside government.
9. Improving water efficiency in the industrial and commercial sectors to achieve cost savings.
10. Achieving water use efficiency in the agricultural sector to create improved efficiency of production and more viable rural communities as well as natural resource protection and restoration.

11. Developing a transparent planning process that identifies water conservation targets and provides meaningful goals for water use efficiency.
12. Encouraging the reuse of stormwater and sewage effluent in order to reduce the demand on existing and new water supply sources.
13. Promoting the use of water efficient appliances equipment in new buildings and improving the labelling system to promote the use of efficient appliances.
14. Ensuring that water conservation is supported and practised throughout the whole community by improving education programs.
15. Reviewing, refocussing and strengthening WaterWise programs in the cities and towns to improve community acceptance and implementation of water conservation measures.
16. Improving education in rural areas through agricultural colleges, TAFE and other institutions as well as the WaterWise on the Farm program to encourage best practice in water use and conservation.
17. Reviewing technical guidelines to provide water users with appropriate information to enable them to take more effective water conservation actions.
18. Undertaking research and development of innovative technologies, processes and methodologies that can be used in the urban and agricultural sectors to achieve water conservation.
19. Developing improved methods and performance indicators for evaluating water conservation measures and planning the most appropriate future direction.

INTRODUCTION

In recent decades the cost of reliably supplying more water from natural sources in New South Wales has escalated dramatically. At the same time, in many areas of the State, the demand for water has increased to a level where there is serious competition between water users and between the various water uses and the maintenance of sustainable ecosystems.

This document sets out the New South Wales Water Conservation Strategy, a set of strategies, aims and actions which will enable New South Wales to use water more efficiently and effectively, to accommodate changes in population, support economic growth and maintain a healthy environment.

The document also reflects the context in which the Water Conservation Strategy was developed and provides information on water use and some current conservation initiatives.

The strategy forms an important part of the New South Wales Water Reforms and falls within the framework of the Council of Australian Governments (COAG) water reforms which were developed to achieve an efficient and sustainable water industry. This framework includes provisions for water entitlements and trading, environmental requirements, institutional reform, public consultation and education, water pricing and research.

'Water conservation' in this context means using water efficiently and equitably so that the needs of ecosystems, human settlements and production are all met sustainably on a permanent basis.

CURRENT SITUATION

WATER AVAILABILITY - THE WATER RESOURCES OF NSW

The natural availability of high quality surface water and groundwater in NSW is complex and, as is common across much of Australia, flows within NSW river systems are extremely variable, between seasons and between years. Even in the high rainfall regions of the State, such as in the northern coastal catchments, river flows are highly erratic and range from very low flow or even no-flow conditions to wild torrents during any year. The ecology of these rivers and associated environments (such as floodplains, wetlands and estuaries) has evolved to accommodate, and is commonly dependent on, this variability.

Many of NSW's largest rivers are 'regulated' to supply downstream users through dams and weirs. State Water, a business area within DLWC, manages about 16 major dams on all of the major inland rivers and three of the coastal rivers, supplying an average of over five million megalitres (ML) of water a year. Water users also access 'off-allocation' flows from regulated systems which are determined after environmental needs are taken into account. Because of the irregular nature of off-allocation flows, users under these arrangements commonly store water taken from rivers in private off river dams.

Most rivers are 'unregulated' but are nevertheless frequently affected by structures that supply water to urban centres and by private water diversions or water harvesting (ie. capturing overland flows in storages). Supply from these 'unregulated' rivers is believed to average over one million ML a year.

Groundwater plays an important role by supplying an average of one million ML each year on a reliable basis. The inland alluvial aquifers generally provide good quality and high yields of groundwater to support significant irrigation activities. Many important coastal and inland urban, stock and domestic supplies are dependent on groundwater.

As a result of Water Reform initiatives the availability of water for consumptive use in NSW is now determined through inter-State agreements (the Murray Darling Basin Ministerial Council cap) and community developed management plans, in partnership with government, that take into account the sustainable yield of the resource. It is anticipated that this Strategy will provide additional input to these plans.

REGIONAL PROFILES

A convenient way of discussing the regional characteristics of water availability and use is to consider the resource in terms of groupings of valleys or catchments. Regional profiles of water storages are briefly summarised in Appendix 2. They show that there is great variability between the regions of NSW and suggest that these variations will need to be incorporated in the application of the principles and actions of this Strategy.

HOW MUCH WATER IS BEING USED IN EACH SECTOR?

The regional profiles indicate how much water is available for consumptive use. The previous section notes that a community and government partnership has been developed to determine appropriate management rules that result in the effective allocation of water between consumptive users and environmental or other instream values. Management decisions for each water source will be supported through various monitoring activities (environmental, social and economic), specific community consultations (such as those used in the development of River Flow Objectives and Water Quality Objectives) and recommendations of other review processes (such as the Healthy Rivers Commission).

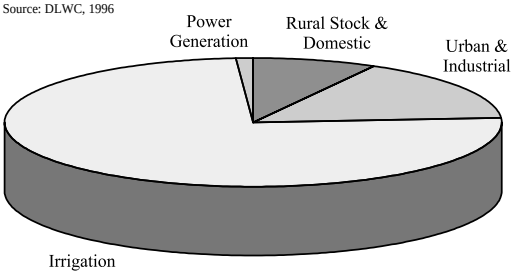
Over the last decade the allocation of water between extractive users and the environment has progressively changed to account for the timing and volumetric needs of the environment. River management committees were set up in 1997 for seven regulated rivers with major Government rural dams and for the Barwon-Darling. Since then, twenty two water management committees

have been set up for unregulated rivers which are stressed or have high conservation value, and aquifers at risk from contamination or over-extraction, with another four committees to be set up by the end of 2000. The committees are preparing plans to advise the Government on options for implementing the river flow, groundwater extraction and water quality objectives in their area; and assess the environmental, economic and social impacts of these options. The committees are made up of major stakeholders including peak and local water user and conservation groups; local government; NSW Government agencies; catchment management committees, boards and trusts; and Aboriginal communities.

This section looks at the relative significance of each sector's water use (agriculture ie. irrigation, urban, industrial) as a proportion of the water allocated for consumptive use.

Chart 1: Annual Sectoral Allocations for Consumptive Water Use, NSW

Source: DLWC, 1996



An estimate of the relative proportion of water used by different sectors in recent years is shown in Chart 1. The agriculture (irrigation) and the urban & industrial sectors are the largest users of water in NSW.

Irrigation is clearly the largest class of water use in NSW in terms of volume. In recent years, the annual value of irrigated production in Australia was around $8 billion. Of this NSW contributes around $2 billion. This represents around half of the value of production of pasture and grasses, the majority of production of vegetables, fruits, grapes, rice and cotton, and contributes to the production of meat, livestock products and grains.

The predominance of irrigation water use is particularly evident in the inland river systems. Chart 2 illustrates average water use over the ten years from 1987 to 1997 by water use (irrigation type, industry and town) for each of the major inland regulated rivers.

The urban sector, including metropolitan water supplies, is the second largest sector of water use in NSW. Chart 3 illustrates the distribution of water use in urban and metropolitan water supply. It is based on figures provided to DLWC (NSW Water Supply and Sewerage Performance Comparisons Report, 1998/99) by NSW water utilities including Sydney and Hunter Water.

Chart 2: Average Annual Regulated Surface Water Use (1987-1997) for DLWC Inland Regions

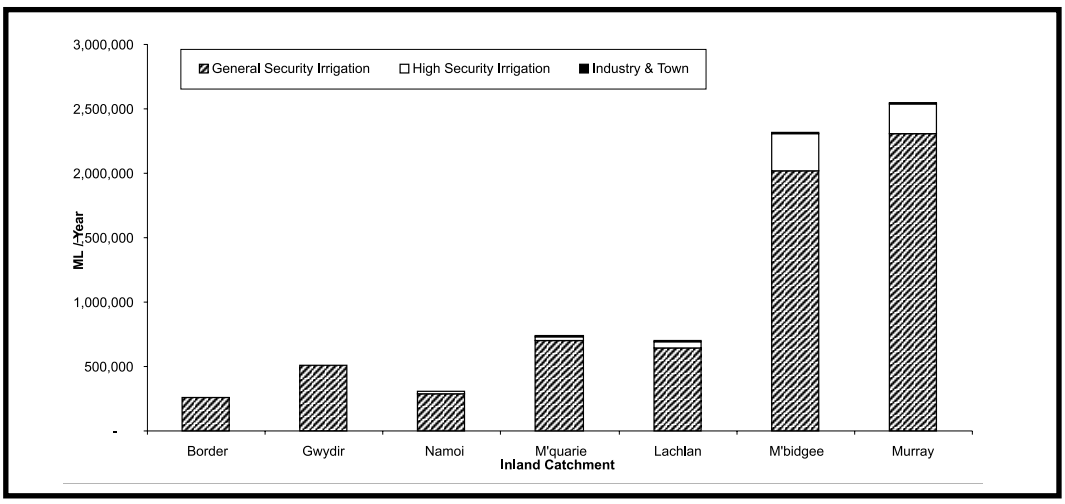
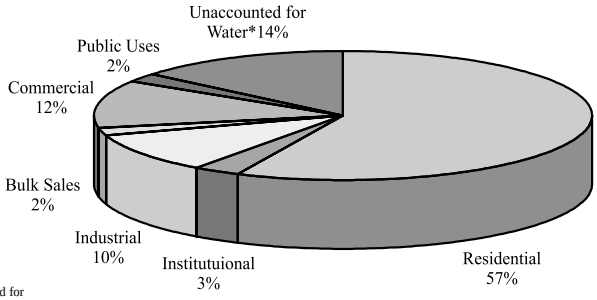


Chart 3: Break-up of Urban and Metropolitan Use in NSW 1998/99

Source: 1995 NSW Supply and Sewerage Performance Comparisons, DLWC

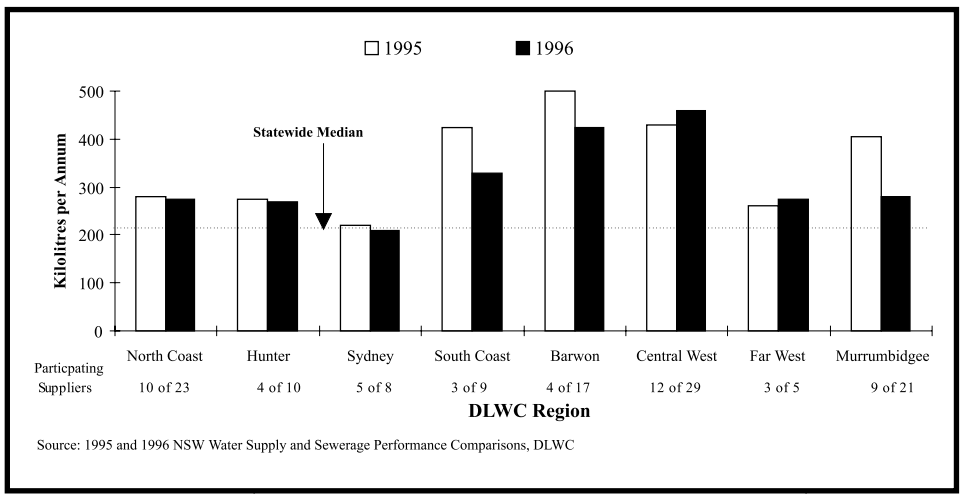
* For consistency with national performance reporting, unaccounted for water includes leakage



Residential water use clearly dominates urban and metropolitan water supply, representing around 57% of the water used in 1998/99. Commercial uses account for 12% and industrial uses 10%. Institutional and public uses amount to 5%. Unaccounted for water, which includes leakage, meter errors, theft and fire fighting amount to 14%.

Chart 4 illustrates the average residential water consumption across NSW by DLWC region. It is based on figures provided to DLWC (NSW Water Supply and Sewerage Performance Comparisons Report, 1995 and 1996) by water utilities in NSW including Sydney and Hunter Water. The number of water utilities providing data included in these average figures is noted at the bottom of the chart. In order to provide reasonable comparisons between 1995 and 1996, the samples were consistent between years. Where only a small proportion of utilities have reported residential consumption figures the information for the region is likely to be less reliable as a representative sample. The chart illustrates the wide variation of average residential consumption between regions.

Chart 4: Average Water Use per Residential Connection by DLWC Region



Source: 1995 and 1996 NSW Water Supply and Sewerage Performance Comparisons, DLWC

POTENTIAL WATER EFFICIENCY GAINS IN NSW

There are significant opportunities for water conservation in all sectors of water use in NSW. Measures that can save water in the various sectors include improving the efficiency of water-using equipment, modifying water use behaviour and practices, efficient application and control of irrigation water use, reducing losses in distribution and reticulation systems, capping artesian bores and maximising effluent reuse.

An important principle in water efficiency improvement is that individual small savings can add up to a large total saving. In each sector there are opportunities for low cost efficiency improvements and each sector should contribute to the overall goal of reducing water use.

In the irrigated agriculture sector, the potential for efficiency improvements varies considerably depending on the crop and the location. In the Lachlan Valley, for example, water use for irrigated maize ranges from 6.8 ML/ha to 11.5 ML/ha, with an even larger variation in yield of crop per unit volume (0.65 tonnes/ML to 1.52 tonnes/ML). For vegetable production in the Murrumbidgee Irrigation Area (MIA), changing from furrow to drip irrigation has resulted in a doubling of yield per unit volume, from 6.2 tonnes/ML (furrow) to 13 tonnes/ML (drip). In many areas of irrigated agriculture, on-farm water efficiency improvements, measured as increased yield per unit volume of 20-50% are not unusual. Many on farm efficiency measures can be implemented at a cost of between $300 to $1500/ML.

In the urban and industrial water use sector, efficiency improvements can be obtained by a combination of pricing reform, regulations, financial incentives and reduction of system losses. Opportunities vary significantly between water service providers depending on the previous history of pricing and other influences, although the potential benefits and costs of improving the efficiency

of water-using equipment is reasonably consistent, as shown for a selection of actions in Table 1. Note that typical household usage in NSW is 250 kL/a.

Unit costs for saving water through water efficiency measures in the urban and industrial sector are typically $100 to $700/ML. The percentage reductions available from standard water efficiency measures range from 10% to 40% of average usage.

In the commercial, institutional and industrial sectors, water savings of 20-30% are often achievable with a 2 to 5 year financial payback for the customer.

Losses from storage, reticulation and distribution systems vary, but in some areas of NSW unaccounted for water exceeds 20% and much of this is leakage. Industry standards suggest that leakage rates can be reduced to below 10% and possibly as low as 5-7%.

There is significant potential for reduction in water use through reuse of effluent and stormwater. Typical costs range from $700/ML for large scale industrial and agricultural reuse to over $3,000/ML for dual reticulation.

The Cap and Pipe the Bores program for the Great Artesian Basin (GAB) also represents an opportunity for an improvement in water efficiency. Water savings from this program are believed to be in the order of 75%.

Table 1: Typical Costs and Benefits for Domestic Water Efficient Appliances

Action	Typical unit cost per household ($)	Typical household saving (kL/a)
Replacing shower head with efficient model	40	25
Installing flow regulators on taps	8-20	10
Replacing top loading with front loading washing machine (additional cost at purchase)	150	20
Replacing toilet with efficient model	300	35

REGULATION AND LEGISLATION

The framework

The NSW Government has statutorily reserved the right to control water use on behalf of the community and, in doing so, it aims to ensure that environmental needs and economic and social benefits to the community are all achieved. The NSW Water Act 1912 amongst other functions provides for licensing of water diversions, charging for water and allocation of water. Under the Water Administration Act 1986, the Water Administration Ministerial Corporation (operating through DLWC) is given the exclusive right to use and control water in rivers and lakes, water naturally occurring on the surface, groundwater and water stored by works such as dams or weirs. Water is shared between extractive users via a licensing system administered by DLWC under the authority of the Water Act. There are various kinds of licences covering a variety of circumstances and as many as 60,000 are administered. The conditions of any licence can be varied and a water diversion or use clearly outside the terms of the licence can lead to it being suspended or even cancelled. The Water Administration Act was amended in 1997 to incorporate the principles of ecologically sustainable development (ESD). However the need for a comprehensive review of the water legislation has been recognised for some time. A bill for the new water legislation was introduced to Parliament on 22 June 2000.

The proposed Water Management Act incorporates the existing provisions, but provides for:

- a clearer definition and protection of water for the environment;
- clarification of water users right to water - licensed and unlicensed access;
- development of water management plans by a community/government committee to set the basis and conditions for water extraction in each catchment and aquifer; and
- consolidation of the various water related Acts.

Urban water

Sydney Water Corporation (SWC) and Hunter Water Corporation (HWC) have licences under

Part 9 of the Water Act. The operating licence of SWC includes specific requirements for demand management. Legislative amendments in 1997 provided for DLWC to issue water management licences for both these Corporations, taking into account the complex situation in harvesting and managing water for urban use.

The Local Government Act 1993 provides the statutory framework for the provision of water supply, sewerage and stormwater services in urban areas of country NSW. Demand management has been included in aspects of non-metropolitan water usage to some extent. The Water Sewerage and Drainage Regulation under the Local Government Act, 1993 was reviewed in 1999. The review encouraged councils to place less reliance on regulation and to use contractual powers to assert provider requirements and to facilitate customer compliance with system wide standards and objectives for water services. Apart from a general requirement for the mandatory use of dual flush toilet cisterns the regulations relating to premises plumbing do not specify the use of particular water conservation products. However water conservation strategies for private premises may be implemented by councils in consultation with their communities. Such strategies may include education programs and guidelines, price subsidies for water conservation products and the use of water conservation conditions of development consent and plumbing approvals.

The activities of a small number of supply authorities are regulated by the Water Supply Authorities Act 1987, including the Broken Hill and Cobar Water Boards and a limited number of city and shire councils. The Act empowers the authorities to provide water supply, sewerage, drainage and flood mitigation services including construction or maintenance of works and to levy fees for services provided.

Surface water licences

Licences on regulated rivers (about 5,800 are in force) specify a volumetric allocation and other conditions such as security of supply (high, general, high flow) and the major activity (irrigation, town water supply, industrial). Licences on unregulated rivers (of which there are some 12,000) are currently being volumetrically converted. This number masks the real number of water users, particularly irrigators, as the large irrigation areas in the southern valleys, some with over two thousand properties, are consolidated into a single licence.

Farm dams, bores and riparian rights

Under the new Farm Dams Policy, 1999, all landholders are able to capture 10% of the average regional rainfall runoff from their land. Previously the legislation allowed a dam of up to 7 ML to be built on a property without the need for a licence, provided it is only used for stock and domestic use. The new Farm Dams Policy, replaces the 7 ML rule and allows the water to be used for any purpose.

Both high yield and stock and domestic bores are required to be licensed. There are approximately 80,000 bores in NSW, with around 40,000 of these being licensed.

Subject to constraints on extraction rates, occupiers of riparian land can take water for domestic use, including watering stock and non-commercial irrigation as specified in the Water Act. Recent trends to subdivide land with river frontages have, in some locations, significantly increased potential diversions through the exercise of riparian rights. The proposed Water Management Act Bill provides for riparian rights to be controlled in declared water source protection zones.

Water savings

Under the existing bulk water volumetric allocation system (currently focused on regulated rivers and high yield groundwater bores) any on-farm or other off-river water efficiency savings are retained by those who invest in the savings. These efficiency gains may be used to extend on-farm production or sold in the licence transfer market. The proceeds of the sale may assist in offsetting the costs of achieving the savings.

Trading

Since the early 1980s, trading in water licences has been permitted on regulated rivers in NSW. Transfers are negotiated between individuals and between 200,000 and 700,000 ML of licensed allocation has been traded annually in recent years,

mostly in the temporary transfer market. Trading arrangements were recently extended to unregulated rivers. Arrangements for groundwater trading are under review.

Pricing and other regulatory controls

Water suppliers are monopoly service providers and their pricing in NSW is subject to determination by the Independent Pricing and Regulatory Tribunal (IPART).

In recent years, IPART has made determinations on the maximum charges that can be levied by large water service providers in NSW (including DLWC, Sydney Water Corporation, Hunter Water Corporation, Gosford and Wyong Councils) and has recommended pricing principles for other urban water suppliers.

There are explicit references to water conservation issues in IPART's determinations. In the 1997/98 price determination for bulk rural water, IPART noted that a principal feature of its determination was to strengthen the emphasis of paying for water actually used, to improve equity and give better price signals to conserve water. Similarly, in 1996 IPART enunciated a set of pricing principles, including "pricing policy should promote ecologically sustainable use of water and the resources to store, manage and deliver that water."

Nonetheless, IPART does not regulate prices for water services with a single focus on water conservation. For bulk water, IPART argues that prices for water services should recover the efficient economic costs incurred in delivering bulk water and administering the associated resource management and licensing activities.

The Council of Australian Governments (COAG) Water Reform Framework requires water to be sold at a price which is cost-reflective, not set by political discretion. There remains some debate about exactly how cost recovery is defined. The NSW government is bound to consider IPART's recommendations in the context of the COAG Agreement.

IPART and water demand management

In its 1993 report the (then called) NSW Government Pricing Tribunal made the following recommendations:

Recommendation 4.1: that water suppliers develop a methodology for evaluating least-cost planning options which incorporates both demand-side and supply-side options.

Recommendation 4.2: that all water suppliers covered by this Review explore and institute demand-side management programs where cost-effective.

Recommendation 4.3: that the government consider measures to encourage all new residential and commercial buildings to be fitted with water-efficient appliances where economic.

Recommendation 4.4: that water suppliers consider rebate schemes to customers who install water efficient appliances where cost-effective.

Recommendation 4.5: that water suppliers provide customers with bills that clearly explain the bill's components and indicate how customers can reduce their bills by conserving water.

Recommendation 4.6: that water suppliers and electricity distributors be encouraged to develop joint energy and water-efficiency programs.

Recommendation 4.7: that water suppliers lead by example in investigating cost-effective ways of reducing water loss in their respective distribution systems.

In 1995, the Tribunal convened a Demand Management Forum of the four metropolitan water agencies and other stakeholders, to assist in the development of the methodology suggested in Recommendation 4.1. In 1996, the Tribunal requested the water agencies to report on which, if any, demand management measures they found to be cost effective after applying the framework and how and when any such measures could be implemented.

CURRENT PROJECTS AND PROGRAMS TO CONSERVE WATER AND IMPROVE EFFICIENCY

There are many existing initiatives promoting water conservation across the major water use sectors. The following sections provide a brief overview of these initiatives. Where appropriate, information is presented on five broad issues - management, financial, research and development, education and information and reuse.

National programs

There are currently three major national programs to conserve water.

The *National Water Conservation Rating and Labelling Scheme* for appliances and plumbing fittings assists customers in choosing water efficient appliances and acts as an incentive and guide for all involved to use and develop water efficient appliances. Sydney Water participates in the scheme and it is similar in concept to the energy labelling 'star' rating for major domestic appliances. However, unlike energy, the water rating scheme is voluntary and the limited funding available means that the scheme still lacks a national marketing profile.

WaterWise Australia is a national program extensively established in NSW. The program aims to encourage wise use of water by the whole community through educational and promotional strategies across water utilities, water industry organisations and state and local governments.

The Commonwealth agency Agriculture, Fisheries and Forestry Australia (AFFA) co-ordinates the development of a *National Water Conservation Strategy* in conjunction with key agencies, industry groups and independent experts from various states and territories. The Strategy has been scoped and possible research projects identified. A short list of priority tasks has been proposed for consideration by the Standing Committee on Agriculture and Resource Management (SCARM).

Bulk water supply and management

A number of significant refinements and changes are occurring in bulk water management, that will promote water conservation, through the NSW Water Reforms. DLWC is the lead manager of these initiatives, and is supported in this role by the Environment Protection Authority (EPA), NSW Agriculture, NSW Fisheries, National Parks and Wildlife Service and other government agencies. Relevant initiatives are described in Case Study 1.

Bulk Water Management Reforms
Case Study 1

Bulk water management reforms that will enhance the efficient use of water and provide for better conservation of water resources include:

- The establishment of committees with representatives from all major stakeholder groups and relevant government agencies to develop management plans for all regulated and unregulated rivers and groundwater systems, including the sharing of water between consumptive users, the environment and other instream values.
- A comprehensive system of water entitlements and allocations is being developed across all water sources. This includes a clear definition of the volumetric shares available to each water user.
- Water licence trading conditions are being enhanced (on regulated rivers) and extended (to unregulated rivers and groundwater systems) to support the efficient use and distribution of existing licences.
- Volumetric Allocation Systems on regulated rivers are being refined to encourage more efficient water use.

IPART has made three bulk water pricing determinations in recent years and in July 1998, recommended price paths for bulk water that will move prices towards cost recovery targets by 2001. These determinations will affect prices paid by water users in agriculture, industry, metropolitan providers and town water suppliers.

Agricultural sector

Various government and industry groups undertake work to improve the efficiency of water use in agriculture. NSW Agriculture, primarily through its Agricultural Resource Management

Program, provides support to the agricultural sector to move towards more efficient use of water.

- The Irrigation Systems and Management (IISM) project aims to increase awareness of crop water requirements, crop behaviour and improve irrigation systems, to increase irrigation skills, and to encourage adoption of best irrigation and drainage management. Other programs provide dryland farmers with information on water use rainfall and soil moisture.
- A project has been initiated to determine groundwater recharge under well-managed, irrigated, perennial pasture for a range of soil types.
- A NSW irrigated agriculture water use efficiency audit project has recently provided comprehensive and up-to-date information on farm, valley and industry assessments of on-farm water use efficiency (WUE) based on current crops, systems and management practices.

IPART's bulk water pricing determinations may encourage some irrigation efficiency gains. In its 1998 determination, IPART recommended price changes which vary depending on the type of water being accessed (ie. regulated, unregulated, groundwater) and the region. Bulk water prices have increased up to 20% per year in the past two years. However, some users will enjoy a reduction in price where they have previously been cross subsidising other users. The "Tribunal is convinced there will be no significant social impact from the maximum prices set in (the) determination. Bulk water prices are too small a proportion of most irrigation businesses' costs to have any significant economic, and thus social, impacts." Nevertheless, the price changes will provide a basic signal to water users.

In 1998, the NSW Government, as part of its Water Reform Structural Adjustment Program (WRSAP), allocated $25M to a five-year Irrigated Agriculture Water Use Efficiency Incentive Scheme. The Scheme is managed by NSW Agriculture and the Rural Assistance Authority and is supported by DLWC. It provides financial incentives to individual irrigators outside areas covered by Land and Water Management Plans to plan, adopt and monitor best irrigation management practices and water efficient technologies (Case Study 2).

NSW Agriculture is involved in a number of education and information programs and activities. *WaterWise on the Farm* is a community awareness and education program for agricultural water users in NSW (Case Study 3). An irrigation education and training program is also run by NSW Agriculture through its Murrumbidgee and Tocal Agricultural Colleges. A nursery industry guide has been developed for irrigation, drainage and water recycling in containerised plant nurseries.

The NSW Agriculture Water Reform Structural Adjustment Program (WRSAP)

Case Study 2

The WRSAP has three objectives:

1. to improve the efficiency, profitability and self reliance of the irrigated agricultural sector.
2. to improve efficiency of water use and environmentally responsible management of water by agriculture.
3. and to encourage the use of water in higher value applications and increase economic returns from irrigated agriculture in NSW.

Activities to meet WRSAP objectives include:

- providing targeted information to irrigators on business planning, best irrigation management practices and technologies, financial assistance and development opportunities (through Farming for the Future, Murrumbidgee College of Agriculture).
- assisting irrigators to prepare business plans that assess their current enterprise status, options for development and their business and training needs to achieve long-term viability (through WaterWise on the Farm, Farming for the Future).
- increasing skills amongst agriculture water users through the development and delivery of appropriate training and education programs (through Farming for the Future, Murrumbidgee College of Agriculture, WaterWise on the Farm).
- improving farm viability by developing and encouraging the adoption of best irrigation and water management practices and technologies (through WaterWise on the Farm).
- maximising community benefits of water use by encouraging increased dollar returns per megalitre of water used by agriculture (through WaterWise on the Farm, Farming for the Future).
- minimising off-farm impacts of water use activities through development and encouraging the adoption of best practice (through WaterWise on the Farm).

The WaterWise on the Farm (WWF) Program

Case Study 3

The NSW WWF program aims to identify, benchmark and document best irrigation management practices, technologies and systems, and through an associated WWF awareness campaign, assist irrigators to identify and adopt methods to improve their on-farm water use efficiency. The WaterWise on the Farm Communication Strategy emphasises irrigation industry involvement in identification of client needs, barriers to effective communication and methods to increase adoption of management techniques and efficient irrigation technologies. Promotional resources, including radio/television community service announcements, water use efficiency poster sets, and information pamphlets have been prepared for use by irrigator associations that promote the efficient use of on-farm water.

Irrigation technical information is being made available through electronic and hard copy formats. NSW Agriculture's WaterWise on the Farm program provides the focus for development and delivery of short courses, seminars and field days for all aspects of irrigation management.

The WWF program continues to actively link with other programs and organisation's that provide services and products to the irrigation community, such as, Streamwatch, Farming for the Future, WaterWise in the Catchment, State and Regional Algae Coordinating Committees, Water user associations and Irrigation Industry bodies. On going liaison with peak irrigation industry bodies to foster joint partnership programs and industry involvement in development and delivery of WaterWise on the Farm continue to evolve.

WWF is gathering momentum in other States, particularly Queensland and Western Australia. Interstate communication is being fostered with a view to establishing a national program.

NSW Agriculture, the Murray-Darling Basin Commission (MDBC) and the Grains Research and Development Corporation, with support from industry, are developing and promoting best management practice including water use best practice for a range of irrigated crops (eg. vegetables, nurseries, perennial horticulture, cotton, wheat, soybeans, maize, lucerne). Benchmarks, including water use benchmarks, to provide guidelines and indicators for sustainable and efficient cropping systems are also being identified (Some examples are presented in Case Studies 4 and 5).

Water Conservation for MIA Vegetable Production

Case Study 4

A drip irrigation demonstration in a rockmelon crop on a large area farm at Whitton in the Murrumbidgee Irrigation area compared efficiency of drip with furrow irrigation. Results from the NSW Agriculture demonstration were as follows:

	Drip Irrigation	Furrow Irrigation
Yield (t/ha)	40	30
Water use (ML/ha)	3.1	4.8
Gross return $/ML	4500	2500

Sub-surface drip irrigation allowed the grower to continue irrigation during the harvest period and therefore extend the harvest period for two weeks (melons are normally harvested every 2-3 days making it logistically difficult to furrow irrigate during the harvest period). Added benefits of drip irrigation as cited by the grower included reduced labour costs, better vine health, and better melon quality. As a direct result of this trial, the farmer established 160 ha of sub-surface drip under melons in the following year.

NSW Agriculture is also providing additional resources to:

- establish current farm water use efficiency levels of different irrigation enterprises. Appendix 4 contains information on efficient NSW Irrigated Farms surveyed in July 1997.
- document irrigation benchmarks and water use efficiency case studies.
- monitor and report on the effects of adopting best management practice on water use efficiency and agricultural productivity.
- disseminate results through case studies, field days, irrigation management workshops and Farming for the Future.
- develop more efficient weather-based irrigation scheduling for improved water use.
- trial field technology for evaluating and monitoring farm water use for furrow irrigation.
- evaluate sub-surface irrigation technology for water conservation and efficiency and

Water Use Benchmarking in the Lachlan Valley

Case Study 5

NSW Agriculture is working with the Lachlan irrigator community and the Lachlan Irrigation Research and Advisory Council Inc. (LIRAC), to improve water use efficiency in the Lachlan Valley.

Benchmarking of irrigated maize and lucerne with growers has commenced. Valley benchmarks have been established for maize for the 1997/98 season's water use. Water use ranged from 6.8 ML/ha to 11.5 ML/ha with crop water use efficiency ranging from 0.65 tonnes to 1.52 tonnes of grain/ML. The top production figures for irrigated maize production in the Lachlan Valley are very close to the benchmark for Benchmark Industry Management Plans (BIMPs) for other areas, which is promising.

Demonstration trials are underway at various locations throughout the Lachlan Valley. There are two trials at the LIRAC Research Farm at Condobolin which are looking into BIMPs and resource management issues associated with irrigated maize.

- develop water management decision support strategies for dryland cropping and livestock enterprises (Case Study 6).

Irrigation Areas and Districts Land and Water Management Plans and corporatisation of government owned irrigation districts include water conservation and efficiency measures as part of the planning and licensing processes.

Projects for increasing wastewater reuse in agriculture include:

- urban wastewater reuse for irrigated agriculture production is being trialed on dairy farms in the Shoalhaven and banana plantations at Coffs Harbour. NSW Agriculture, DLWC and the Department of Public Works and Services (DPWS) in co-operation with Sydney and Hunter Water have undertaken a preliminary evaluation of regional effluent management schemes involving reuse of treated effluent to increase agricultural production at 13 locations across NSW.
- developing and promoting sustainable reuse of drainage and effluent water from farming systems and intensive agricultural developments and
- developing and promoting dairy waste water management systems for the conservation of water and sustainable reuse of effluent.

Metropolitan water - Sydney Water and Hunter Water

Sydney Water Corporation supplies water to Sydney and Illawarra urban areas. Hunter Water Corporation supplies to Newcastle metropolitan area. Both Sydney Water and Hunter Water actively pursue a number of significant water conservation programs.

Sydney Water's major policies and plans on water conservation are:

- a specific aim to improve the system efficiency by reducing the quantity of water withdrawn from all storages on a per capita basis by at least 25% between 1990/91 and the year 2000/01 and 35% by 2010/11. It must also aim to reduce unaccounted-for losses from its water systems to a maximum of 15% by the year 2000/2001.
- an evaluation of customer demand and supply-side options through a Least Cost Planning framework and model and developing implementation plans for programs to improve water efficiency, reductions in system losses and expanded reuse and a demand management strategy (published in October 1995) to achieve these targets.

Water Use Efficiency of Dryland Winter Crops

Case Study 6

Water use efficiency (WUE) is a measure of the effectiveness with which a winter crop has utilised the rainfall received during the growing season (GSR). Effective rainfall for winter crops is defined as the rainfall received between April and October less 110 mm for evaporation losses. WUE is a very good measure for integrating the effects of climate, soil management and crop husbandry on plant growth and grain yield. This measure, when compared with the potential WUE that a winter crop should achieve, is an excellent benchmark for assessing the performance of individual crops to the above factors.

The formula used for determining WUE (kg grain/ha/mm) is:

$$WUE = \frac{\text{Grain yield (kg/ha)}}{\text{(GSR - 110)}}$$

The highest WUE that is considered achievable by winter cereal crops is 20 kg grain /ha/mm, and by winter broadleaf crops is 15 kg grain /ha/mm. When winter crops are grown using traditional farming practices (e.g. wheat 3-4 cultivations, grassy pasture and a pasture/oat/wheat rotation) WUE varies from 14 kg grain in a dry season (GSR of 250 mm) to 9 kg grain /ha/mm in a wet season (GSR of 450 mm). The higher WUE in the dry season results from a greater reliance on stored soil water for grain fill. The lower WUE in the wet season results from ineffective utilisation of GSR due to increased water run-off, water logging, accession to water tables, soil borne diseases and soil nitrogen leaching.

Research by NSW Agriculture has shown an effective rotation of broadleaf and cereal crops can dramatically increase the efficient use of water. When wheat crops are grown after a canola crop the WUE of wheat is increased from 14 to 21 kg grain in a dry season, and from 9 to 14 kg grain /ha/mm in a wet season. The dry season WUE highlights the very efficient use of stored soil moisture when factors such as cereal diseases are reduced through an effective 'break' crop.

The average WUE of winter crops grown in the Cowra Shire during a five-year period for a range of seasonal conditions is shown in the following table. The Cowra district has an average GSR of 360 mm.

Table: Water use efficiency of dryland winter crops in the Cowra Shire.

Crop	250 mm GSR	350 mm GSR	450 mm GSR
Canola	**9**	**7**	**6**
Lupin	**11**	**9**	**7**
Wheat	**17**	**14**	**11**
Barley	**21**	**17**	**13**

The higher WUE of barley results from a greater tolerance of the soilborne disease, take-all, coupled with earlier flowering and grain fill.

Crop rotation is the most important factor affecting the WUE of dryland cereal crops. Sound soil management can increase the WUE of cereals further provided crop nutrition and weed management is best practice. The WUE of winter wheat, canola and faba bean crops can be increased by almost 20% when the correct varieties of these crops are sown in April rather than May. The higher grain yields of early sown crops result from higher dry matter yields at flowering, cool mild nights during grain fill and greater drying of the soil profile.

Sydney Water has a diverse group of clients, from the industrial, commercial and residential sectors. Programs include a model water, energy and stormwater efficiency policy manual to promote the wider adoption of energy and water saving features in both renovated and new dwellings, presentations to Regional and Corporate Customer Councils and active participation in national programs (WaterWise Australia, National Water Week and the Rating and Labelling Scheme).

The Hunter Water Corporation's demand management strategies, which have existed for well over a decade, have led people in the lower Hunter to consume up to 30% less than most other areas in Australia.

Sydney Water and Hunter Water's prices are set by IPART. They include a usage based tariff and a fixed charge for water service access. A property tax component has been removed from tariffs and recovery of costs from users has been a major focus of pricing reform. In 1996, IPART determined a four year price path for each of these Corporations. It provides the organisations and their customers with a degree of certainty about the operating environment. Demand management is an important part of the operating environment with reductions in water usage impacting on the Corporations' revenue.

In Sydney Water's area of operation, as at June 1998, 29 ML/day was being reused. This is around 2% of the Sydney region's daily effluent production of almost 1,200 ML/day. Some of this non-potable water is being reused for irrigating golf courses, university grounds, race tracks and by industry.

Sydney Water has introduced Waterplan 21 as part of the NSW Government's Waterways Package. It focuses on increasing the amount of water reused, promoting and building new markets for water reuse, lowering the cost of water reuse and gaining community acceptance of water reuse.

The specific strategy in relation to potable recycling is:

Next 5 Years - Evaluate international research and applications of potable recycling, initiate involvement in international research groups such as the Water Environment Research Foundation, and monitor advanced treatment schemes such as Gerringong/Gerroa, Cronulla STP and Caboolture.

5-10 Years - Re-evaluate the need for a pilot potable water recycling scheme

10-20 Years - Based on water demand forecasts, customer preference, market factors, economic viability, and technology development, progress the development of additional greywater recycling or potable recycling.

A major conservation strategy in the Hunter involves industrial use of treated effluent. Water conservation activities undertaken during 1997/98 included:

- recycling of around 6,150 ML of effluent (around 14% of all effluent treated).
- further refinement of prices to provide users with an incentive to conserve water, and promotion of water conservation through radio and print media and advertising, participation in community events, tours of operations etc.

In Hunter Water's area of operation, on average, almost 10% (3,400 ML) of dry weather effluent flowing from Hunter Water's wastewater treatment facilities is recycled (1996/97). It is estimated that an additional 2,600 ML of effluent was indirectly used by irrigators in 1996/97.

Sydney Water has conducted research and mounted campaigns to influence customer behaviour in conservation (Case Studies 7 and 8).

Stringybark Grove - Sustainable Development Pilot Project

Case Study 7

Stringybark Grove is a medium density development in the Sydney suburb of Lane Cove. It consists of ten two-storey dwellings on 2.7 ha of land. Environmental sustainability was a key theme in the design and construction of the project which aims to demonstrate that energy and water savings can be built into conventional medium density housing without compromising comfort or lifestyle. Sydney Water installed detailed monitoring equipment for water usage on every water outlet (up to 23 metered points per dwelling).

Water saving initiatives included:

- The installation of water efficient fittings and appliances.
- A rainwater collection and recycling system supplying water for toilets and garden usage. and
- Low maintenance gardens, without lawns, using trees and shrubs native to the area.

Monitoring showed that:

- Total consumption, 451 litres per dwelling per day was about 30-35% below similar non-water efficient housing.
- 16% of total consumption was from recycled rainwater.
- 87-101 litres per dwelling per day was used by each of the following - showers, kitchen sink and the laundry.
- 64 litres per dwelling per day was used by toilets, and
- Peak demand was between 7.00pm and 8.00pm.

Conclusions:

- The use of water efficient devices reduced water usage compared with average homes Sydney wide.
- The cost of installing recycled water system and rainwater tanks was approximately $4,100 per dwelling. With recycled water usage at 27.3 kL per dwelling per annum, at an equivalent price of $0.76 for potable water for 1996/97, this usage amounts to a saving of $20.70 per annum. The costs of these systems at present considerably outweighs the direct savings to the households. and
- Water efficient fittings were found to deliver much more cost-effective water savings than rainwater collection and recycling.

Department of Housing Retrofits

Case Study 8

This program is managed by the Sustainable Energy Development Authority (SEDA)in conjunction with the Department of Housing and Sydney Water. It involves water efficiency device retrofits (installing water efficient shower heads, tap flow controllers, cistern flush reduction devices) to 3,300 Department owned houses in Western Sydney area. Retrofits were completed by the end of August 1998.

Rebates - Lismore City Council Hardware Incentives Trial, 1993

Case Study 9

Lismore City Council carried out an incentives trial program, starting in October 1993, in which domestic customers were offered a cash rebate on the purchase price of water-saving shower head or 6/3 litre dual flush toilets. Lismore City Council distributes and sells water to 10,000 customers. The trial was considered a great success in terms of the response by customers, and positive feedback from the community.
The trial costed $28,000 which included marketing and co-ordination, and has reduced demand by an estimated 13 ML of water per year. This means that the levelled cost of the saved water from this trial is approximately 14c to 21c/kL, significantly less than the marginal cost of water from a proposed new water supply option. The number of participants in the trial represented about 5% of customers.

Non-metropolitan urban supplies

Water supply, sewerage and stormwater services to the 1.6 million people in urban areas of non-metropolitan NSW are provided by 126 local government councils, together with the Broken Hill Water Board and the Fish River Water Supply. The Annual NSW Water Supply and Sewerage Performance Report co-ordinated by DLWC provides information on the statewide median annual residential consumption per property. The data indicate that consumption has progressively reduced over the last 6 years from 300 kL/a/property to 210 kL/a/property, although this may partially reflect sample changes.

IPART has recommended a set of pricing principles to be followed by the non-metropolitan authorities. These seek to achieve charges for water on a 'pay-for-use' basis, with a tariff involving an access charge together with either a single charge or increasing charges for higher levels of use. A successful rebate trial in Lismore in 1993 showed that the cost of rebates was much less than the marginal cost of augmented supplies (Case Study 9).

WaterWise in the Catchment is managed by DLWC. At present about 60 out of 128 country councils are WaterWise partners. The WaterWise program is currently being reviewed with a view to a more strategic approach to its delivery. A pilot scheme is being developed in the Central West region of NSW to report on the cost and benefits of a WaterWise Program.

Rous County Council has introduced a range of diverse and effective demand management strategies, including rebates, education and water audits (Case Study 10).

Rous County Council Regional Demand Management Strategy
Case Study 10

In 1996/97, Rous County Council implemented several major water efficiency programs. The programs include:

1. Water Efficient Shower Head Program - over 3,400 high quality water efficient shower heads have been sold to householders at reduced cost ($1 and $10) as an incentive, accompanied by a major promotion and demonstration of their effectiveness. Each shower head will reduce water consumption by about 25 kL/a which will reduce total demand by over 85 ML/a.
2. Water Efficient Washing Machine Program - a $150 cash-back incentive is offered to customers at point of sale to purchase a front loading washing machine, rather than a top loading one. Each front loading washing machine will save about 20 kL/a. The NSW Sustainable Energy Development Authority (SEDA) and Northpower contribute to this program.
3. Non-Residential Water Efficiency Program - to assist non-residential customers such as shops, offices, factories, schools and council undertakings to reduce their demand for water. A detailed and comprehensive water audit is offered at no cost, resulting in a Water Saving Action Plan. The audits themselves are worth approximately $1,500 to $2,000 in staff time, and the potential savings that are identified by the Water Saving Action Plans are on average in excess of 30% of water use.
4. The Residential Indoor Water Efficiency Program reduces water use through the installation of water efficient shower heads and tap flow regulators. Customers pay $15 and a plumber comes to their house to install the shower heads and taps and also to repair leaking toilets and taps. SEDA contributes to this program. The total cost of the strategy is approximately $550,000.

Water use in government agencies

Since 1996 NSW Government agencies have been encouraged to save water, through information brochures such as "Water Saving in State and Local Government".

Water conservation measures adopted in government agencies include installing water saving devices, conducting audits of water use and encouraging staff to reduce water consumption. The Hydraulics Group of DPWS has estimated that annual government expenditure on water and sewage charges across the whole-of-government is around $36M and that there is scope for saving about $9M of this (Case Study 11).

Other areas

Mining, power generation and other industries are significant end users of water. Industries which use high volumes of water in their operations are regarded as potential direct bulk users and are licensed accordingly. Where other industries are located in areas covered by urban water supply authorities, as a matter of policy, the government has not provided the towns with additional water to meet industrial needs. These industries have had to purchase entitlements and be separately licensed. The NSW water reform process is looking at better defining town water supply.

Water Audits

Case Study 11

Since 1992 the Hydraulics Group in DPWS has conducted water audits in different organisations. The main findings were:

- Water audits in six NSW public hospitals identified approximately 30% in savings. It was also estimated that the costs of water audits could be recovered in savings on water charges within 3 years. The rate of return on investment in identified saving measures is in the order of 15 to 25%.
- In addition, several instances of incorrect metering have been identified, leading to refunds totalling $897,000 to agencies.
- In 5½ years these water audits have identified opportunities to save a total of 1,050 ML per year, enough to supply 4,200 new homes.
- The aggregate saving to Government from full implementation of the recommendations to date exceeds $2.4M in 1997/98.
- The cumulative savings to date amount to about $9.5M (in 1997/98 dollars).
- If account is taken of the future savings to agencies from the audits to date, the total net present value of savings is in the order of $33M (7% discount rate over 30 years).
- The Hydraulics Group has also prepared long term four year programs for TAFE and the Department of Corrective Services for their operations within the whole of the state, and
- Sydney Water in conjunction with Manly Council has completed a water audit (Feb 1998) to reduce water wastage and identify conservation options in high tourist traffic areas along the Manly beachfront.

Salinity Discharge Trial - Hunter Catchment

Case Study 12

A management scheme is being trialed to reduce salinity levels while allowing mines and industry to discharge excess water. This is being achieved by controlling the timing of mine water discharge to coincide with periods of high flows in the river. Saline waters are thus rapidly diluted and flushed out of the system.

Salinity could be manipulated by controlled water releases from DLWC dams which have a relatively low level of salinity compared to the Hunter tributaries. This means releasing enough fresh water from the dams to dilute the saline mine water when it enters the river. Results to date indicate that the trial is having a positive effect on salinity levels.

The EPA has developed the pilot Hunter Salinity Trading Scheme to complement traditional forms of regulation and education programs. The objective is to ensure river salinity remains below 900 EC units at Singleton and below 600 EC units at Denman during salinity discharge events.

The scheme sets a limit on the total amount (tonnes) of salt which can be discharged into the river and divides this limit among licensed operators (an electricity generator and coal mines). The operators holding 'salinity credits' can discharge, up to the limit of their share of the total allowable discharge, into the river only when flows are high.

Credits can be traded amongst licenced dischargers. This gives individual industries some flexibility in deciding best timing and mix of control measures to use to reduce compliance costs. Maximum responsibility for environmental outcomes is transferred back to the polluters under conditions of high accountability.

The Hunter catchment is an example of a region with mixed end use of water including industry, agriculture, dairy and urban. Major industries located in the area include power generation, coal mining, heavy industry, agriculture and associated business and infrastructure. Drought conditions and wastewater discharge regulations have put pressure on these industries to improve their water efficiency. Wastewater from towns is being reused by industries such as coal mines and power stations.

One of the primary water quality indicators, salinity, is a major problem in surface and groundwater resources in NSW. High levels of salinity in rivers may restrict water use for a number of purposes including industries and agriculture. Salinity reduces the lifespan of domestic and industrial equipment leading to higher maintenance costs and greater use of cleaning products. Salinity problems can be attributed to a number of causes including human activities. In the Hunter River, increasing salt level has been attributed to coal mining, farming, power generation and industry. Some industries, particularly mining, periodically discharge excess saline water off-site. A number of measures have been undertaken to manage this problem (Case Study 12).

CONCLUSION

This review of the current situation in New South Wales demonstrates that the most important principles in water conservation and water use efficiency improvement is that individual small savings can add up to a large total saving. In each sector and region there are opportunities for low cost efficiency improvements and each sector should contribute to the overall goal of reducing water use.

STRATEGIES FOR WATER CONSERVATION

An integrated package of 19 strategies has been developed to guide government, industries, the community and other stakeholders to achieve significant improvements in water conservation in New South Wales. These strategies were based on the principles set out earlier and are the means by which the Government will achieve the vision for water conservation. The strategies range from research and education to financial incentives and water-efficient appliances. Actions need to be taken by all groups involved in water use in New South Wales – local and state governments, industry organisations, householders, and professional organisations. The State Government cannot, and should not, be expected to carry the responsibility for water conservation alone.

STRATEGY 1. CREATING PARTNERSHIPS

Aim: To achieve commitment to water conservation throughout New South Wales.

Partnership arrangements between government and non-government parties have the potential to break down historical barriers, strengthen water conservation actions and assist in market transformation. Many stormwater management projects and plans under the NSW Government's Urban Stormwater programs use a partnership approach with the relevant Local Councils sharing responsibilities with agencies, industry and community and environmental groups. Likewise Land and Water Management Plans and Irrigation Drainage and Management Plans are being developed and implemented as partnerships with irrigation communities. This approach could be further developed in New South Wales.

Actions: Government and other groups with an interest in water resources to:

1.1 Create opportunities for fostering partnerships;

1.2 Encourage adoption of the vision and principles for water conservation by all sectors so that efforts to develop appropriate strategies are cooperative, consistent and comprehensive;

1.3 Encourage non-government investment or cost sharing in water conservation programs and projects; and

1.4 Request Water Management Committees to identify specific regional opportunities to establish partnerships and structures to implement the Strategy.

STRATEGY 2. AUDITING STATE WATER RESOURCES

Aim: To ensure a better understanding of New South Wales water resources that will accommodate beneficial uses and define use by sector.

The condition, availability and use of the State's water resources are not well enough understood. Periodic reviews of the state of regional water resources are conducted by government agencies or in the development of river flow and water quality objectives, in the State of the Rivers and Estuaries Reports and in the proposed State Water Monitoring Strategy. A better understanding of New South Wales water resources will accommodate beneficial uses more appropriately.

Actions:

2.1 Continue the review of the State's water resources. The review should cover regulated and unregulated rivers and groundwater and define use by sector to better target water conservation opportunities;

2.2 DLWC to continue to actively engage with the National Land and Water Resources Audit to see how the Audit can be of assistance to New South Wales; and

2.3 DLWC in collaboration with the Bureau of Meteorology to design and implement a comprehensive flow gauging and data management program. The program should focus on unregulated rivers and be prioritised to allocate resources to the most critical areas.

STRATEGY 3. DECISION-MAKING BASED ON ECOLOGICALLY SUSTAINABLE DEVELOPMENT (ESD) PRINCIPLES

Aim : To integrate environmental, economic and social costs and benefits into decision making on water conservation.

It is widely acknowledged that environmental and economic benefits result from conserving water. These include greater security of supply and providing environmental flows. It is less widely realised that the environmental benefits of water conservation have indirect social advantages such as a more healthy living environment and increased biodiversity. Realisation of these advantages is likely to result in a greater community acceptance and adoption of water conservation techniques and technologies.

The principles of ecologically sustainable development (ESD) provide a useful framework

for assessing the costs and benefits of water conservation. The principles of ESD consist of a responsibility to future generations, the precautionary principle, conservation of ecosystems and biodiversity, environmental valuation and natural resource accounting and encompass economic, environmental, social and equity considerations. The effective valuation of environmental, economic and social costs and benefits needs to be integrated into decision-making processes related to water conservation. A number of guidelines have been or are being developed which can be used as a guide.

Actions: Government to ensure:

3.1 Effective integration of the principles of Ecologically Sustainable Development (particularly the valuation of social, economic and environmental costs) into all decision making related to water conservation; and

3.2 Greater public prominence of the links between environmental, economic and social factors and consideration of these links in decisions on water conservation.

STRATEGY 4. ACKNOWLEDGING BEST PRACTICE

Aim: To promote and encourage best practice water use efficiency and conservation throughout the community.

The WaterWise programs for catchments, gardens and homes has had some involvement with garden competitions, and competitions to promote water use efficient technologies and management. Farmer groups and irrigation communities in the Murray and Murrumbidgee valleys have been involved in these programs. NSW Agriculture's WaterWise on the Farm program proposes to hold regional irrigation farm of the year awards in other areas.

Actions:

4.1 NSW Government, Local Government and Industry Groups to support water conservation awards and investigate the possibility of merging existing awards into a highly publicised annual Water Conservation Awards.

STRATEGY 5. PRICING AND VALUING WATER

Aim: To have clearer price signals that provide strong incentives for efficient use and conservation of water.

Estimating the true cost of supplying water, including all environmental and social costs, is a challenging task. Both the COAG Water Reform Framework and IPART in its bulk water pricing determinations have sought to ensure that the principle of 'full cost recovery' is implemented.

Water prices incorporating volumetric user charges that reflect the real cost of water are an essential first step in achieving water use efficiency improvements. The principles of ESD have been written into key environmental protection legislation, and a broad range of guidelines and policies require water to be correctly valued and priced. Significant system-wide environmental costs that continue to be borne by the community indicate the need for clearer signals embodied in water prices of the environmental damage from water use.

The IPART determination for bulk water pricing recommends that water pricing should reflect environmental costs. IPART recognises the link between environmental damage and water use and river regulation and suggests that environmental externalities be included within the user charge.

There are several well established techniques for valuing environmental impacts, and guidelines at international, national and State levels are available.

Trading in bulk water licences has occurred in NSW since the early 1980's. This allows licence holders to realise the value of any operational efficiency savings and help fund the relevant investment.

Actions: Government to:

5.1 Ensure that government rates and charges progressively move to reflect the full economic costs of water use and water quality degradation; This includes the cost caused by environmental damage and by natural resource management, or 'externalities';

5.2 Ensure that water allocation and charges are structured as an incentive to achieve greater water use efficiency; and

5.3 Structure and develop a water market with incentives to promote efficient water use.

STRATEGY 6. PROVIDING DIRECT FINANCIAL INCENTIVES

Aim: To encourage water users in all sectors to invest in water efficient equipment and adoption of water efficient practices.

Pricing water at its true cost and providing information to water users on means of improving water use efficiency are essential steps in achieving the water conservation outcomes supported by this Strategy. However, by themselves they are not likely to achieve the level of investment in water use efficiency improvements that is appropriate from a whole-of-society perspective, or that is required to meet the constraints that are being addressed by this Strategy. It is important for water users in all sectors to be encouraged to invest in conserving water and achieving efficiencies.

There are many other barriers that are best addressed by providing financial incentives for installation of water-efficient equipment and adoption of water-efficient practices. Some such schemes already exist, including the Sydney Water - Sustainable Energy Development Authority Smart Shower Head Program, the Country Town Water Supply and Sewerage Program and the New South Wales Irrigated Agriculture Water Efficiency Incentives Scheme.

Financial incentives can take a number of forms and include rebates, grants, loans, give away programs, no-cost installation, tax breaks, reduced water licence or hookup fees and reductions in fixed water charges. The appropriate target and level of investment needs to be considered on a catchment and supply system basis and take into account existing efficiency levels and the total costs and benefits to all stakeholders.

Actions: Government to:

6.1 Encourage supply authorities, service providers and other relevant agencies to provide financial incentives to water users for installing water-efficient equipment and adopting water-efficient practices.

STRATEGY 7. INTEGRATING WATER CONSERVATION PRINCIPLES INTO POLICY AND LEGISLATION

Aim: To incorporate consistent water conservation principles into policy and legislation.

The objectives of the proposed Water Management Act are to allow for the sustainable and integrated management of water resources of NSW. Some objectives of the proposed Act include the application of ESD principles, encouraging the shared responsibility of government and water users for the wise and efficient use of water, encouraging a total water cycle management approach by individuals, companies and water utilities and encouraging best practice in the management and use of water resources.

Actions: Government to.

7.1 Ensure that all government agencies adopt the vision and principles for water conservation in the Strategy as a basis for future policy development and legislative review relating to water; and

7.2 Require reporting in State of the Environment reports on the incorporation of water conservation principles into agency policies and legislation.

STRATEGY 8. GOVERNMENT LEADING BY EXAMPLE

Aim: To demonstrate government's commitment to water conservation.

The government can demonstrate its commitment to water conservation by adopting best practice water conservation methods throughout the public sector. The financial savings achieved by implementing water efficiency plans commonly outweigh the cost of water audits. Since 1992 DPWS has conducted water audits and developed

plans for water use efficiency for some public sector agencies and institutions which have resulted in impressive savings.

Encouraging all government agencies and local government to undertake water audits will result in significant savings in both water and money. The program should involve three phases: conducting water audits, implementing the plans to achieve the identified water and cost savings and monitoring and reporting by individual agencies.

Wide publicity of the water and cost savings achieved would encourage non-government areas to follow the Government's lead.

Actions: Government to:

8.1 Encourage all government agencies and local governments to implement a water efficiency program and monitor water use at their premises and facilities to achieve cost effective water efficiency savings. Organisations with high water usage and / or significant water saving potential should undertake water audits;

8.2 Ensure water conservation plans are implemented where financial savings are identified through the water audit process and monitoring progress (to be funded through normal budgetary processes);

8.3 Ensure appropriate minimum water efficiency standards are met in new government-owned and government-leased buildings; and

8.4 Undertake cost-effective efficiency improvements to Department of Housing properties.

STRATEGY 9. IMPROVING WATER EFFICIENCY IN THE INDUSTRIAL AND COMMERCIAL SECTORS

Aim: To increase water use efficiency in commerce and industry.

There is a need to identify losses and inefficient use of water in the industrial and commercial sectors. A national benchmarking exercise with links to international experience will allow industries to have the widest possible comparisons with their own performance. This can best be achieved through a partnership between government, industry and trade associations that have a stake in the outcomes. Large users also need to recognise the value of water as an input to their business as well as an output, since costs are incurred in disposing of effluent. This will achieve increased water use efficiency in commerce and industry.

Actions:

9.1 Water authorities and industry associations such as the Australian Water Association to encourage commercial and industrial users to undertake water audits and develop water use efficiency plans;

9.2 AWA to initiate a training and accreditation program for undertaking water audits in the residential, commercial, industrial and agricultural sectors; and

9.3 Government to promote and facilitate introduction of a national database and benchmarking process to establish meaningful measures of best practice in commerce and industry for specific water consumption.

STRATEGY 10. AGRICULTURAL WATER USE EFFICIENCY

Aim: To increase water use efficiency in agriculture sector.

Adoption of industry best practice through implementation of Land and Water Management Plans (LWMPs) is a condition of Irrigation Corporation licensing by both DLWC and the EPA. Similarly, adoption of agricultural best management practice may be a condition of consent for major agricultural developments requiring planning approval. New irrigation licences require environmental assessment and irrigation and drainage management plans that satisfactorily address best practice and irrigation efficiency. Similar conditions could apply to existing licences at renewal so that adoption of best management practices can help overcome inefficient irrigation water use.

Irrigation and drainage management planning by irrigators is fundamental to improving crop water use efficiency at the farm level. Monitoring the amount of water used for irrigation and the volume of food and fibre produced from that water is an essential element of the process, but is undertaken poorly at present.

Water management planning by dryland farmers is necessary to ensure conservation of water for stock and domestic needs as well as efficient use of rainfall and soil moisture for crop and pasture production.

NSW Agriculture is devoting resources from the Water Reform Structural Adjustment Program to improving irrigators skills and facilitating the adoption of more efficient irrigation systems. The NSW Agriculture/DLWC Water Efficiency Advisory Unit at Dubbo will establish water use efficiency bench marks, and collect and disseminate water use efficiency information to farmers, industry and rural community groups.

There is a need to save water and create efficiencies in the irrigated agricultural sector by improving the efficiency of production and in doing so, support more viable rural communities. This will result in natural resource protection and restoration.

Actions:

10.1 Agricultural sector to encourage water use efficiency and water conservation to continue as an industry priority;

10.2 NSW Agriculture and DLWC Water Efficiency Advisory Unit to support implementation of the New South Wales Water Conservation Strategy in the agricultural sector;

10.3 NSW Agriculture to facilitate adoption of water use efficiency and water conservation best practice by agricultural industries and enterprises;

10.4 Irrigators adopt irrigation and drainage management planning in non-LWMP areas and continue supporting the implementation of approved LWMPs in irrigation districts and areas; and

10.5 State and Commonwealth government agencies to improve data collection and dissemination about agricultural water use and irrigation productivity at the farm, catchment and regional scale to establish benchmarks and examples of best practice against which industry members can compare their own achievements.

STRATEGY 11. DEVELOPING WATER CONSERVATION TARGETS

Aim: To identify goals or targets for water use efficiency to be adopted by water supply authorities.

Least-cost planning processes can be used to determine the best way to meet the water-related needs of the community. This can be done through water supply options and investment in improved water use efficiency. There is a need for a transparent planning process that identifies achievable goals for water use efficiency and determines strategies for reducing water. There is also a need to ensure that these goals or targets are adopted by water suppliers. The potential benefit for water suppliers of a reduction in demand include delayed or reduced capital expenditure on water treatment plant augmentation and wastewater collection and treatment improvements. Customers may benefit through reduced water and electricity bills.

Actions: Water supply planning processes to:

11.1 To incorporate least cost planning principles and, where appropriate, reduce demand for water by taking into account demand and supply-side options; and

11.2 Lead to the development of targets for implementation of water use efficiency measures, adoption of best management practices, and reductions in unaccounted-for water and per capita use.

STRATEGY 12. EXPANDING THE ROLE OF WATER REUSE

Aim: To promote water reuse for reducing demand for new water supply sources and environmental and monetary cost savings.

Water reuse has the potential to be a major contributor to water conservation by providing an alternative to using the raw water sources and provides for the matching of water quality to water usage more sustainably. The management of wastewater needs to occur within a framework based on total water cycle management and requires an integrated approach to planning and investing in sewerage services, water supply and stormwater management as advocated in the Codd Report into Management of Sewage in the Coastal zones.

Although further research, education and funding are required, the present opportunities to develop appropriate reuse options could be maximised by clear whole of government policy on effluent management and reuse. Both opportunities and limitations to implement reuse exist and resource managers need to present the best mix of options for each individual situation recognising physical, economic, social, health and environmental characteristics.

Actions:

12.1 Government to develop a whole-of-government policy on effluent management and reuse;

12.2 EPA in consultation with Local Government, the Water Corporations and the Roads and Traffic Authority to develop a consistent policy on stormwater reuse and coordinate the implementation of this policy through the local council's stormwater management plans;

12.3 Government through the Australian Water Association (AWA) and other industry groups to review the adequacy of current funding mechanisms for reuse schemes and recommend the most effective funding arrangements;

12.4 Government to coordinate and prioritise research on public health and environmental risks of non potable water reuse;

12.5 Government to ensure continued research into the effects of effluent reuse on soils and groundwater, and into the benefits of effluent reuse in agriculture, develop best practice manuals for reuse applications and develop strategic advanced pilot reuse schemes;

12.6 Local government to encourage the development of on-site reuse in new buildings and developments through the introduction of regulations, development and building controls or incentives;

12.7 Government and local government jointly educate the community about the value and potential uses of reclaimed water; and

12.8 Research into potable reuse such as that being undertaken by Sydney Water as part of its Waterplan 21, to continue.

STRATEGY 13. NEW DEVELOPMENTS, APPLIANCES AND LABELLING

Aim: To introduce water efficient equipment and appliances in new developments and promote the water appliance rating scheme.

In New South Wales, the energy efficiency of new buildings is becoming the subject of a more comprehensive approach. Examples are the New South Wales Energy Smart Homes Program and the national Building Energy Code.

There is no comparable comprehensive approach to water efficiency, despite the fact that new developments provide ideal opportunities for the introduction of water-efficient equipment and appliances since the additional cost is usually lower than for replacement in existing buildings.

A model policy tool kit has been developed for the Inner Metropolitan Regional Organisation of Councils (IMROC) which provides implementation plans for councils to regulate the water efficiency of new buildings. In order for education and financial incentives to be most effective, a mandatory labelling scheme needs to exist to allow identification and promotion of water-efficient products. In the 1980s, over $2M was invested by the New South Wales, Victorian and South Australian Governments to develop the

Energy Labelling Scheme which requires mandatory labelling of electrical appliances nationally and has resulted in an increase in the efficiency of appliances sold. Although a similar water-efficient appliance labelling scheme exists, it is not mandatory and requires review and development.

Regulating the minimum water efficiency of water-using equipment such as shower heads, washing machines and other fixtures and appliances is the lowest-cost, most effective long-term water conservation measure. Regulating, with a suitable lead time, the manufacturing, import and sale of shower heads and washing machines to AAA-rated products could save about 60 GL/a for shower heads and 50 GL/a for washing machines in the longer term (Sydney's total water demand is 600 GL/a). Minimum energy performance standards have now been introduced as part of the National Greenhouse Strategy (NGS) for hot water systems, freezers and refrigerators. In the United States, the minimum water efficiency levels for shower heads were specified in Federal law in 1992.

Actions: Government to:

13.1 Assist local governments to introduce requirements for the installation of water-efficient appliances, fixtures and equipment in all new buildings and major renovations; and

13.2 Promote the further development of the national water conservation rating and labelling to at least an equivalent level to energy labelling.

STRATEGY 14. IMPROVING EDUCATION PROGRAMS

Aim: To strengthen education programs including the water wise programs.

Some surveys on community attitudes to water conservation and reuse have already been undertaken. Examples are Sydney Water's survey of community and school children's views on water conservation and NSW Agriculture's review of the communication needs of irrigators to achieve WaterWise on the Farm objectives. However, there has been no comprehensive assessment of the success of education programs such as WaterWise in the Garden/Home/Catchment, the water conservation education program initiated in New South Wales by DLWC.

Without knowledge of the community's responses to education about water conservation, the effectiveness of these programs cannot be optimised.

Actions: Government to:

14.1 Recognise that an overarching WaterWise program for New South Wales is essential and initiate an immediate review to refocus and strengthen the suite of WaterWise programs to ensure improvements in community understanding, acceptance and implementation of water conservation principles;

14.2 Undertake a benchmark survey of knowledge, attitudes, skills and behaviour of New South Wales people in relation to water conservation. Then:

- Repeat this survey every three years to monitor the community's response to water conservation issues;
- Use information from the surveys and other techniques to (a) identify barriers to, and opportunities for, improving water conservation behaviour and (b) design strategies for promoting water conservation; and

14.3 Monitor and evaluate the effectiveness of education programs.

STRATEGY 15. WATERWISE AND EDUCATION IN THE CITIES AND TOWNS

Aim: To review, refocus and strengthen education programs including WaterWise in Catchment/Home/Garden.

A program such as WaterWise is an essential vehicle for water education. WaterWise has been responsible for a number of outstanding water conservation and education initiatives. However, it is generally agreed that in its traditional areas of

the garden, home and catchments etc. the program currently lacks the resources and focus to achieve its full potential. Although the WaterWise programs are widely recognised by the community, if they are to be effective in achieving water conservation they need to be more strategic and better supported

Actions: Government to:

15.1 Further promote WaterWise in the Catchment/Home/Garden; and

15.2 Expand the partnership between WaterWise and local government.

STRATEGY 16. WATERWISE AND EDUCATION IN RURAL AREAS

Aim: To strengthen education programs including WaterWise on the Farm in rural areas.

The WaterWise on the Farm program, which is a central component of the Water Reform Structural Adjustment Program, aims to identify and document best irrigation management practices, technologies and systems. Through an associated awareness and education campaign, it also aims to assist irrigators to identify and adopt methods to improve their on-farm water use efficiency. Water management education for all farmers is provided through New South Wales Agricultural College home study material such as 'Farm Water', 'Managing Waterways on Farms' and 'Managing Wetlands on the Farm'.

A recent survey of irrigators revealed that most irrigators do not use objective measures to determine when to irrigate due to a lack of knowledge of industry best practice. This has resulted in poor production and environmental degradation.

In the Riverland region of South Australia and the Sunraysia region of south-western New South Wales and northern Victoria, competency-based irrigation management and training of irrigation farmers has resulted in improved irrigation management.

Education in the agricultural sector is required to increase awareness of the importance of water conservation and reduce environmental degradation caused by poor irrigation practice.

Actions: Government to:

16.1 Continue funding formal education programs with emphasis on water use efficiency and water conservation through Agricultural Colleges, TAFE and other institutions;

16.2 NSW Agriculture to ensure that education and awareness of water conservation for dryland and irrigated agriculture is delivered through the WaterWise on the Farm and Farming for the Future programs, and through competency-based training, home study and self-directed learning courses provided by Murrumbidgee and Tocal Agricultural Colleges; and

16.3 NSW Agriculture/DLWC Water Use Efficiency Advisory Unit participate in education and training programs to increase the skills of irrigators and dryland farmers skills in water conservation.

STRATEGY 17. REVIEWING TECHNICAL GUIDELINES

Aim: To provide water users with appropriate technical guidelines.

Currently, many technical guidelines and information documents on water conservation have been prepared by different organisations. These cover broad areas such as effluent reuse for urban and residential use, water use and efficiency in irrigation, policy options for greywater reuse and stormwater, a demand management manual for water authorities, water supply and sewerage management guidelines etc. Most have specific target users, and many serve a purpose for a limited time and then become unnecessary or obsolete.

At present there appear to be a few gaps in the existing array of guidelines. Guidelines providing technical data on water-efficient equipment, processes or research and development and detailed information and training materials for conducting water audits in the different sectors would be useful. However, a review of the

process by which most guidelines are developed has revealed that guidelines are generally developed in a timely way to meet emerging needs.

There is a need for appropriate technical guidelines to be made available to water users.

Actions:

17.1 Industries to be encouraged to publicise available guidelines relevant to their users, periodically review emerging needs and make appropriate arrangements for further guidelines through their own resources.

STRATEGY 18. RESEARCH AND DEVELOPMENT IN WATER CONSERVATION

Aim: To increase R&D activity in water use efficiency to increase the opportunity for developing technologies, processes and methodologies in NSW.

Irrigation R&D, funded through such agencies as Land and Water Resources Research and Development Corporation (LWRRDC), MDBC and the Cooperative Research Centres is addressing some aspects of environmental impact, technology adoption and improved management. Benchmarking is necessary to determine the potential for improvement in irrigated agriculture. New management techniques which integrate the potential of newer irrigation systems with existing management constraints need to be developed locally.

Commodity R&D corporations attract Federal Government funding based on farmer levies. Very few of these corporations (the rice industry through the Rural Industries Research and Development Corporation is one notable exception) allocate significant R&D funds to irrigated agricultural production and technology development associated with water use efficiency and water conservation.

Investment in R&D is also required in the urban sector. A key issue is the actual implementation of existing technology which for a variety of reasons is often not adopted. An increase in R&D activity would increase the opportunity for developing technologies, processes and methodologies in New South Wales and for coordination of the research that is currently under way. Additional gaps in research include the need to develop methodologies for the design and evaluation of water conservation measures and programs, barriers to implementation and the social and economic issues associated with them. There is also considerable potential for the development of innovative technologies for water conservation. Development of a vigorous water conservation research and development program in New South Wales has the potential to generate significant commercial opportunities, in addition to the benefits which would accrue to the community and the environment.

Actions: Government to:

18.1 Through existing research centres and organisations, initiate projects in all sectors (a) which develop technologies and processes for improving water use efficiency to commercial levels and (b) which develop methodologies for the design and evaluation of water use efficiency measures or programs including research into social and economic aspects;

18.2 Continue contributing to R&D programs in NSW Agriculture for developing best practice for water conservation and water use efficiency for sustainable agriculture;

18.3 Encourage other agricultural industries which are dependent on water as an input to production to follow the lead of the rice industry in contributing to research; and

18.4 Assist in the development of collaborative arrangements between government, industry and the research community to further research in water conservation, particularly research sponsorship possibilities.

STRATEGY 19. EVALUATING WATER CONSERVATION MEASURES

Aim: To have monitoring and evaluation procedures that will provide guidance for the future direction of water conservation measures and programs.

A number of organisations have undertaken water conservation measures through various programs. However, there has been no comprehensive assessment of the success or otherwise of these programs. It is essential that such organisations have monitoring and evaluation procedures in place. This includes maintaining an efficient database that provides useful benchmark data for effective comparisons and that performance indicators of successful conservation measures be adopted. This will provide guidance for the future direction of conservation measures and programs.

Actions:

19.1 All metropolitan and rural town water suppliers in New South Wales be required to maintain and report on reliable water consumption and end-use data for major customer sectors (residential, non-residential and unaccounted-for water) which will provide benchmarking resources and detect any improvements in overall efficiency; and

19.2 The irrigation community, including NSW Agriculture, AIC, ANCID, Irrigation Association and the NSW Irrigators' Council, to agree on and implement a protocol to measure and record efficiency and benchmark enterprises. The NSW Agriculture/DLWC Water Use Efficiency Advisory Unit to co-ordinate / facilitate this action.

MONITORING AND REPORTING PROCESS

The following monitoring and reporting process is to be adopted:

- Progress on the implementation of the Strategy will be monitored and reported once in three years;
- DLWC will be the lead agency co-ordinating and compiling a report on progress towards implementation of the NSW Water Conservation Strategy;
- Lead agencies, industry organisations and other groups identified in the implementation plan for specific actions and tasks will report to DLWC regarding progress on implementation; and
- Minister for Land and Water Conservation will report to the Natural Resources Sub Committee of Cabinet on the progress of the NSW Water Conservation Strategy.

GLOSSARY

allocation	the water declared by DLWC to be available to water user, normally expressed as a proportion of a licensed entitlement
bulk water	water supplied in large amounts to an organisation which then supplies it to end users
catchment	the area determined by topographic features within which rainfall will contribute to run-off at a particular point under consideration
cap	the limit placed on taking water from streams in the Murray-Darling Basin, equivalent to the water demands at 1993-94 levels of development
COAG	Council of Australian Governments – a meeting of the Prime Minister and state and territory leaders
DLWC	Department of Land and Water Conservation, NSW
DPWS	Department of Public Works and Services
embargo	a statutory declaration that no further water entitlements will be issued
Ecologically Sustainable Development (ESD)	the effective integration of economic and environmental considerations in decision making processes through the implementation of precautionary, inter-generational equity, biological diversity, ecological integrity principles and improved valuation and pricing of environmental resources (Section 3 (1), Water Administration Act 1986)
general security licence	a licence for which the available water varies from year to year with the climate, normally for irrigating annual crops
high security licence	a licence for which the entitlement is provided at 100% security, except in exceptional circumstances
entitlement	the volume or share of water which a person is authorised to take under a water licence
EPA	Environment Protection Authority, NSW
extractive water use	a water use which involves taking water for use from a water body by pumping, diverting or extracting it
gigalitre	a thousand mega litres or a thousand million litres
groundwater	water which occurs naturally under the surface of the ground
Hunter Water	Hunter Water Corporation
IPART	Independent Pricing and Regulatory Tribunal of NSW
licence	an authorisation, issued under the Water Act, to take water from a river or stream, to impound water within a river or stream or to extract water from an aquifer.

megalitre (ML)	a million litres
off-allocation	water in a regulated river declared available for extraction, after a review of environmental needs, over and above the announced water allocation. These are flows that are in excess of regulated storage capacity or that enter the river system through tributaries below the major regulatory structures.
riparian	adjacent to or associated with the bank of a river or the foreshore of a lake or other water body
regulated river	a river declared under Section 22 of the Water Act to have the flow or supply of water augmented by a dam
runoff	rainfall which actually reaches a water storage or stream
stock and domestic	water for house, garden and stock watering purposes
Sydney Water	Sydney Water Corporation
unregulated river	a river whose flow and water supply is not augmented by dams and is not declared under Section 22 of the Water Act
wastewater	sewage or, in an industrial context, effluent from factories
water access right	an approval which authorises a person to take water from a water body or source
water transfer market	buying and selling of water entitlements

APPENDIX 1
WATER CONSERVATION TASK FORCE MEMBERSHIP

The Task Force consisted of government and non-government stakeholders, so that a whole-of-government approach can be taken, in partnership with the community.

Membership of the Task Force comprised:

Ms Lorraine Cairnes (Chair)	Executive Director, Fathom Consulting
Mr Mitchell Laginestra	NSW President, Australian Water and Wastewater Association (alternate: Mr Chris Davis)
Ms Lisa Corbyn	Assistant Director-General, Environment Protection Authority (alternate: Ms Barbara Richardson)
Dr Mike Curll	General Manager, Strategic Review, NSW Agriculture
Mr Gary Donovan	Secretary, NSW Irrigators' Council
Dr Judi Hansen	Manager, Product Planning, Sydney Water Corporation
Mr Peter Prineas	Vice Chair, Nature Conservation Council of NSW
Mr John Scott	Director, Policy and Reform, Department of Local Government
Clr Les Wardman	Local Government and Shires Associations
Dr Stuart White	Senior Research Fellow, Institute for Sustainable Futures
Ms Christine Cowie	Manager, Water Unit, Environmental Health, NSW Health (alternate: Mr Adrian Farrant)
Ms Netta Holmes	dryland agriculture representative
Mr Des Cleary	Executive Director, Sustainable Water Management, Department of Land and Water Conservation

APPENDIX 2 REGIONAL PROFILES

1. NORTH COAST REGION

The North Coast covers 50,000 square kilometres comprising the Tweed, Brunswick, Richmond, Clarence, Bellinger, Nambucca, Macleay and Hastings catchments. Because of the high rainfall and topography, the proportion of rainfall as runoff is high producing over 12 million ML a year in river flows. There is also great seasonal variation in river flows. Only one small catchment is regulated for irrigation, namely, the Toonumbar Dam (capacity 11,000 ML) on Iron Pot/Eden Creek. Many councils have constructed small storages for urban supplies, namely, Clarrie Hall (16,000 ML) on the Tweed. Rocky Creek Dam (14,000 ML) on the Richmond. Karangi Dam (8,000 ML) on the Orara River and Malpas Dam on the upper Macleay.

Along the north coast of NSW, groundwater is a significant source of domestic, town water and agricultural supply. An important area for agricultural production dependent on groundwater is the Alstonville Plateau, in the upper Richmond catchment, where 5,800 ML of groundwater is allocated. Of the total 36,100 ML of groundwater that is annually allocated in the region, over 20,000 is allocated for towns.

2. HUNTER REGION

The Hunter Region covers an area of 34,900 square kilometres comprising the Hunter, Manning and Karuah catchments. The major storages on the Hunter System include Glenbawn Dam (750,000 ML) on the Hunter river, Lake St Clair (283,000 ML) on Glennies Creek, Lockstock Dam (20,000 ML) on the Paterson river and Chichester Dam (22,000 ML) on the Chichester river and Grahamstown (132,000 ML). Water plays a vital role in the region's development. Glenbawn, Glennies Creek and Lostock dams are used to regulate water flow in irrigation and power generation. The Chichester and Grahamstown serve as a domestic water storage for urban centres in the lower Hunter. In addition to the dammed water, 14% of the Lower Hunter's water needs is pumped from bores and wells in the coastal sand beds between Stockton and Port Stephens. A total of 5.83 million ML annual average river flow discharge is generated from the three major rivers (Hunter, Manning and Karuah) in the region.

The Hunter Region has diverse and substantial industrial, agricultural and town water supply activities. Currently there is a rapid expansion in mining, industrial (electricity generation) and urban developments. There is a high level of riparian usage on the unregulated rivers and stock and domestic usage of groundwater. Water quality is a driving factor with various consumers demanding different levels of quality.

3. SYDNEY SOUTH COAST REGION

The Sydney South Coast Region covers an area of 53,700 square kilometres and comprises the major catchments of the Hawkesbury Nepean, Shoalhaven, Georges, Hacking, Clyde, Bega and Snowy Rivers. A total of 12 million ML annual average river flow discharge is generated from all the rivers in the region, providing approximately 33% of the total discharge from all NSW rivers.

With the exception of the relatively small Brogo Dam (9,800 ML), situated on the Brogo River, upstream of Bega, DLWC does not operate any major water storages in the south coast region. Sydney Water Corporation impounds 2.7 million ML in eight storages on the Upper Nepean, Warragamba, Shoalhaven and Woronora Rivers. Pejar and Sooley dams impound 13,500 ML for Goulburn City water supply purposes, whilst Delta Electricity impounds 65,300 ML for electricity generation on the Coxs River arm of the Hawkesbury-Nepean.

Groundwater is an important source of water for town, stock, domestic and industrial requirements within the region and for export (bottled water). Bega Valley Shire Council holds licences authorising town water supply from borefields at Bega and at Kiah on the Towamba River for Eden's supplies.

4. BARWON REGION

The Barwon Region, in north-western NSW, covers an area of 94,000 square kilometres and includes three major catchments: the Namoi, Gwydir and Border Rivers systems (shared with Queensland). These are tributaries of the Barwon-Darling River and their flows vary greatly from year to year. These rivers also provide significant amounts of water to recharge the GAB.

Namoi Catchment

Three main storages have been constructed on the Namoi River with a combined storage capacity of 884,000 ML. The maximum annual allocation from Keepit and Split Rock Dams for the Namoi system is 264,600 ML. Many irrigators in the valley also have controlled access to off-allocation water to supplement regulated flows. The estimated capacity of on-farm storage in the lower Namoi is 144,000 ML.

The old Namoi River valley provides large quantities of low salinity, high yielding groundwater. The upper Namoi catchment yields significant quantities of good quality groundwater for irrigation and town water supplies. Groundwater accounts for around half of the water used for irrigation in the Namoi Valley, but in drought years it can be the major water source. Alluvial aquifers in the Region are now fully committed or overcommitted and allocations have been reduced from 10% to 35% in the more stressed areas.

Gwydir Catchment

In the Gwydir Catchment there is only one major storage, Copeton Dam, with a capacity of 1,364,000 ML. The catchment is larger than the Namoi and the catchment yield is similar. Maximum annual allocation in the Gwydir valley is 528,400 ML. The Gwydir system has a lower reliability for water users than the Namoi and greater frequency of reduced allocations. The total capacity of on-farm storage in the Gwydir is approximately 330,000 ML.

Groundwater is a major source of water in the Gwydir catchment. Use is concentrated in the areas north and north-west of Moree where it is use to supplement surface water supplies.

Border Rivers Catchment

The Border Rivers are managed under agreement between NSW and Queensland, Glenlyon Dam (capacity 253,000 ML) in Queensland provides regulated supplies to NSW, while the Pindari Dam (312,000 ML) supplies additional water to users on the NSW side of the Macintyre River. The maximum annual allocations from Pindari and Glenlyon Dams for irrigation in NSW is 262,000 ML. Irrigators in the region rely heavily on off-allocation flows to supplement water supplies. Groundwater usage is concentrated in the alluvial sediments associated with the Dumaresq River.

5. CENTRAL WEST REGION

The Central West Region in mid-western NSW, covers an area of 175,000 square kilometres and encompasses the Macquarie, Castlereagh, Bogan and Lachlan River Valleys which form part of the Murray-Darling Basin. Flows vary greatly from year to year and major storages have been built to store water and provide more regular supplies for water users.

Macquarie Catchment

On the Macquarie River, Burrendong Dam and the smaller Windamere Dam provide a combined storage capacity of 1,557,000 ML. Groundwater usage is high in the area around Narromine.

Lachlan Catchment

On the Lachlan River, there are two storages - Wyangala and Carcoar Dams - with a combined capacity of 1,253,000 ML as well as two re-regulating storages - Lakes Cargelligo and Brewster. Surface water supplies support significant irrigation activities and for the Jemalong Irrigation Area. There are large high quality supplies of alluvial groundwater, particularly in the lower reaches of the catchment. Groundwater usage is high in the area around Cowra.

6. FAR WEST REGION

The Far West encompasses western NSW, an area of 335,000 square kilometres, with one major river system but two distinct sections. The upper reaches of the Barwon-Darling River from Mungindi to Menindee is unregulated. The lower

reaches of the Darling River are regulated by Menindee Lakes.

The flows of the Barwon-Darling River are affected by the regulation and water extractions in its major upstream tributaries - the Border, Gwydir, Namoi and Macquarie Rivers (see Barwon and Central West Regions above). They are also affected by flows emanating from the Narran, Bokhara, Culgoa, Warrego and Paroo systems. Seventeen weirs modify highly variable natural flows and large private off-river storages have also been constructed to store water (capacity 230,000 ML).

The Great Artesian Basin

The GAB underlies around 22% of Australia's land surface. It services and supplements town, domestic, stock and mining water requirements across large reaches of semi-arid Queensland, New South Wales, South Australia and the Northern Territory. Most of the water extracted is used to water stock. The GAB carries water from intake beds along the western slopes of the Great Dividing Range below western Queensland and NSW, through ten confined aquifers that are up to 3 kilometres thick. Water leaves the Basin naturally through small discharge areas, seeps and mound springs. In some parts of the basin, the movement of water through the aquifers is so slow that it approximates geological time frames (ie. centimetres per year). Land use in the region overlying the GAB in NSW is dominated by sheep and cattle grazing. Sheep grazing is focused in the south eastern portion, while cattle grazing dominates the northern and western areas. Mining occurs sporadically throughout the region.

Current extraction levels exceed the GAB's sustainable yield, resulting in declining artesian pressures. Previously free flowing bores and springs are drying up, increasing the cost of access and jeopardising unique ecosystems. Overuse is due to inefficient distribution through open drains and channels, rather than excessive demand. Uncontrolled access to open drains and channels also appears to be significantly distorting the regional ecology.

7. MURRAY REGION

The River Murray system covers an area of 108,000 square kilometres and is regulated by the Hume Dam (capacity over 3,030,000 ML). the Dartmouth Dam, upstream of Hume on the Victorian Mitta Mitta River (capacity over 4,000,000 ML) and the Menindee Lakes storage scheme (capacity greater than 2,000,000 ML). The combined coverage of these storages is around 453 square kilometres.

Water in the valley is managed under an agreement between NSW, Victoria and South Australia. Surface water supplies support significant irrigation activity throughout the valley including Murray Irrigation Limited and Western Murray Irrigation in NSW and various regional bulk water authorities in Victoria.

Groundwater is becoming an increasingly important resource in the Murray Region, particularly in years of drought when access to regulated surface water may be restricted.

8. MURRUMBIDGEE REGION

The Murrumbidgee Region in south-western NSW covers an area of 84,000 square kilometres, encompassing the Murrumbidgee River Valley. Flows vary greatly from year to year, and major storages have been built to store water and to provide more regular supplies for water users, including part of the Snowy Mountains Hydro-Electric scheme and supplies to the Australian Capital Territory and Queanbeyan. There are 14 major dams, 7 major weirs, 1 regulatory storage and over 10,000 kilometres of irrigation canals in the region. Burrinjuck and Blowering Dams are the largest storages with a combined capacity of 2,600,000 ML. Surface water support irrigation activities along the major river system including a variety of irrigation areas and districts (such as the Murrumbidgee Irrigation Area and the Coleambally Irrigation Area)

Groundwater is a major source of water in the Murrumbidgee Region. The alluvial sediments provide large quantities of low salinity, high-yielding groundwater supplies. The major area of groundwater use is west of Narrandera.

Regional Summaries - Catchments, Major Storages and Urban Centres

Region	Area (km^2)	Catchments	Name of Major Dam or Weir	Storage Capacity (ML)	Groundwater (ML)	Major Urban Centres
North Coast	50,000	Tweed, Brunswick, Richmond, Clarence, Bellinger, Nambucca, Macleay, Hastings	Toonumber Dam - Iron Pot/ Eden Creek Clarrie Hall Dam - Tweed R Rocky Creek Dam - Richmond R Karangi Dam - Orara R Malpas Dam - Upper Macleay R	11,000 16,000 14,000 8,000 n/a	36,100 (over 20,000 for towns)	Grafton, Lismore, Coffs Harbour
Hunter	39,000	Hunter, Wyong, Karuah, Manning	Glenbawn Dam Glennies Dam Lostock Dam Hunter Water Corporation Chichester Grahamstown Tomago (Aquifer)	750,000 283,000 20,000 22,000 132,000	n/a 38,000	Singleton, Muswellbrook, Newcastle Gosford
Sydney / South Coast	53,700	Hawkesbury-Nepean, Shoalhaven, Georges, Hacking, Clyde, Bega, Snowy	Brogo Dam - Brogo R Sydney Water Corporation (all dams) Warragamba Avon Cordeaux Cataract Pejar, Sooley Dams Delta Electricity - Coxs R	9,800 2,700,000 1,886,000 146,700 93,640 94,300 13,500 65,300	For town, stock, domestic and industry	Sydney, Wollongong, Nowra, Bega
Barwon	94,000	Namoi, Gwydir, Border	Chaffey Dam - Peel R Split Rock Dam - Manilla R Keepit Dam - Namoi R On farm storages - Namoi R Copeton Dam - Gwydir R On farm storages - Gwydir R Glenlyon Dam - Border Rivers Pindari Dam - Severn R	62,000 397,000 425,000 144,000 1,364,000 330,000 253,000 312,000	Half of water used for irrigation in Namoi valley	Tamworth, Gunnedah, Narrabri, Walgett
Central West	175,000	Macquarie, Castlereagh, Bogan, Lachlan Valley	Burrendong, Windamere Dam Wyangala, Carcoar Dams Chiefly	1,557,000 1,253,000	Usage high - Narromine, Cowra	Cowra, Forbes, Bathurst, Dubbo, Condobolin
Far West	335,000	Barwon River, Darling	17 weirs Private off river storages	n/a 230,000	Important for domestic, stock and mining	Mungindi, Collarenebri, Brewarrina, Bourke
Murray	108,000	Darling River Valley (Lower), Menindee Lakes	Hume Dam - Murray R Dartmouth Dam - Mitta Mitta R Menindee Lakes Storage	3,030,000 4,000,000 2,000,000	Important - in drought	Albury, Deniliquin, Wentworth
M'bidgee	84,000	Murrumbidgee River Valley	Burrinjuck, Blowering Dam 14 Dams, 7 weirs	2,600,000 n/a	Major use - west of Narrandera	Wagga Wagga, Griffith, Leeton, Queanbeyan

APPENDIX 3 EFFICIENT IRRIGATED FARMS

Valley/ Region	Location	Enterprise	Reason for efficiency	Quantity of product per ML	Quantity of product per ha	ML per ha	$ return per ML
Hawkesbury Nepean	Sydney Basin	Hydroponic lettuce	Irrigation water recycling	800,000 units	240,000 units (poly house)	0.8per annum	$300,000
	Sydney Basin	Greenhouse cucumbers	Micro irrigation	25t	220t	4.5	$36,500
North Coast	Richmond, Clarence	Dairy	Bike shift irrigation systems Efficient grazing practices Irrigation scheduling	3.33t	20t (dry matter) 5,000L/ha increase per annum	6	$616.50 increased return per ML @ 30c/l
	Dorrigo	Dairy	Irrigation scheduling		25% increase in fodder production	5.8	27% increase in milk value @ 30c/l
	Nurseries	Ornamental plants	On site collection and re-use of irrigation and rain water. Reduced fertiliser leaching. High level management			35% reduction in water use 7 indoor 6 outdoor	Increased income Less waste/ more production $65,000 $200,000
	Lismore	Macadamia	Irrigation scheduling (3 year trial)	1.7t		4	$5124
	Numulgi	Low chill stone fruit	Irrigation scheduling (3 Year trial) increased water savings by 28.6% and returns by 38.3%	1t	3.5t	3.3	$7094
Hunter	Denman	Wine grapes	Drip irrigation Irrigation scheduling	9.4t white 6.9t red	15t white 11t red	1.6	$11,280 white $7,370 red
Barwon Region	Moree	Cotton	On-farm storage and recycling systems Storm water recycling Irrigation scheduling Integrated water use strategy -	1 bale	9 bales	9	$500
		Cotton	Efficient furrow irrigation	1 bale	8 bales	8	$500
		Lucerne	Efficient spray and flood irrigation	2.6t	20t	7.7	$440
		Maize	Efficient furrow irrigation	1.8t	12.5t	6.9	$321
		Sorghum	Efficient furrow irrigation	2t	10t	5.0	$320
		Sunflowers	Efficient furrow irrigation	0.8t	4t	5.0	$272
		Soybean	Efficient furrow irrigation	0.7 t	4t	5.7	$250

Surveyed in July 1997

Valley/ Region	Location	Enterprise	Reason for efficiency	Quantity of product per ML	Quantity of product per ha	ML per ha	$ return per ML
Macquarie Valley	Narromine	Sweet corn	High level of management Irrigation scheduling Use of pivot irrigation	4.5t	21.9t	4.9	
	Trangie	Cotton	Drip irrigation on red soils. Irrigation scheduling	1.4t bales	8 bales	5.5	$725
Macquarie Valley	Dubbo	Lucerne, sweet corn, soybeans, wheat/ canola	Centre Pivot irrigation Irrigation scheduling	8t	17t low pressure pivot system 20t Sideroll system	2 low pressure pivot system 2.5 Sideroll system produces $32/ML energy savings	
Lachlan Valley	Jemalong Irrigation District	Lucerne, Hay and Cubes	Landformed surface irrigation, tailwater recycling Irrigation scheduling	1.8t	20t (4t per Ha per cut)	11	$360
	Gooloogong	Sweet corn/ processing tomatoes	Centre pivot spray irrigation Irrigation scheduling High energy costs	Sweet corn 6.8t Tomatoes 17.5t	Sweet corn 18.5 Tomatoes 70t	Sweet Corn 2.7 Tomatoes 4	Sweet Corn $850 Tomatoes $1,750
Murray	Finley, Berriquin Irrigation District	Dairy	Whole farm plan, drainage recycling, and land forming High level of management	98kg milk solids	1231kg milk solids		$280
	Barooga	Processing tomatoes	Drip irrigation High level of management	12.7t	70t	5.5ML	
Murray/ M'bidgee	Southern Murray Darling Basin (MDBC Benchmarking study)	Wheat	High level on-farm management		7.8t		$363
	Southern Murray Darling Basin (MDBC Benchmarking study)	Maize	High level on-farm management		17.7t		$258

Surveyed in July 1997

Valley/ Region	Location	Enterprise	Reason for efficiency	Quantity of product per ML	Quantity of product per ha	ML per ha	$ return per ML
Murray/ M'bidgee *(continued)*	Southern Murray Darling Basin (MDBC Benchmarking study)	Soybeans	High level on-farm management		4.5t		$333
	Southern Murray Darling Basin (MDBC Benchmarking study)	Rice	High level on-farm management		12.8t		$271
	Southern Murray Darling Basin (MDBC Benchmarking study)	Tomatoes	High level on-farm management		133t		$2242
	Southern Murray Darling Basin (MDBC Benchmarking study)	Lucerne	High level on-farm management		19.5t		$633
M'bidgee	Tharbogang	Wine grapes, Chardonnay	Riverina twin furrow Regulated deficit irrigation management and soil moisture monitoring	3.8t	14t	3.7	$4,540
	Whitton	Tomatoes Maize Feed Maize Pop Corn	Row crop irrigation with recycling Irrigation scheduling	16t 1.5t 1.6t 0.6t	103t 12t 15t 5t	6.4 8.0 9.4 8.3	$1,474 $300 $266 $250
	Hanwood	Wine grapes	Drip irrigation Regulated deficit irrigation management and soil moisture monitoring	6.1t	8t	1.3	$7,380/ ML
	Benerambah	Gherkins	Sub-surface drip irrigation Irrigation scheduling	13.33t	40t	3	
Lower Murray Darling	Buronga Curlwaa	Wine grapes	Drip and under canopy spray Irrigation scheduling	2.85t	20t	7	$3,420

Information contained within this table has been obtained from NSW Agriculture Irrigation Officers, industry journals and research, following a survey conducted in July 1997.