Submission
No 128

INQUIRY INTO A SUSTAINABLE WATER SUPPLY FOR SYDNEY

Organisation: NSW Government

Name: The Hon Morris Iemma MP

Position: Premier

Telephone: 9228 5239

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Subject:

Summary

Premier of New South Wales
Australia

17 FEB 2006

Legislative Council
GENERAL PURPOSE
STANDING COMMITTEES

21 FEB 2006

RECEIVED

The Hon Ian Cohen MLC
Chair
Legislative Council General Purpose Standing Committee No. 5
Parliament House
Macquarie Street
SYDNEY NSW 2000

Dear Mr Cohen

Inquiry into a Sustainable Water Supply for Sydney

I am pleased to provide the NSW Government submission for the Inquiry into a Sustainable Water Supply for Sydney.

Enclosed are the *Progress Report on the Metropolitan Water Plan* recently released by the Government and the *Review of the Metropolitan Water Plan* prepared for the Government by the Institute for Sustainable Futures, ACIL Tasman and the Snowy Mountains Engineering Corporation.

These documents articulate the progress made on a range of initiatives since release of the 2004 Metropolitan Water Plan. The key measures presented in the Progress Report will secure ongoing water supplies for Sydney both during normal times and periods of drought.

I commend these reports to the Committee for consideration, and note that over the next few months I will be releasing further information about the Government's plans for Sydney's water supply.

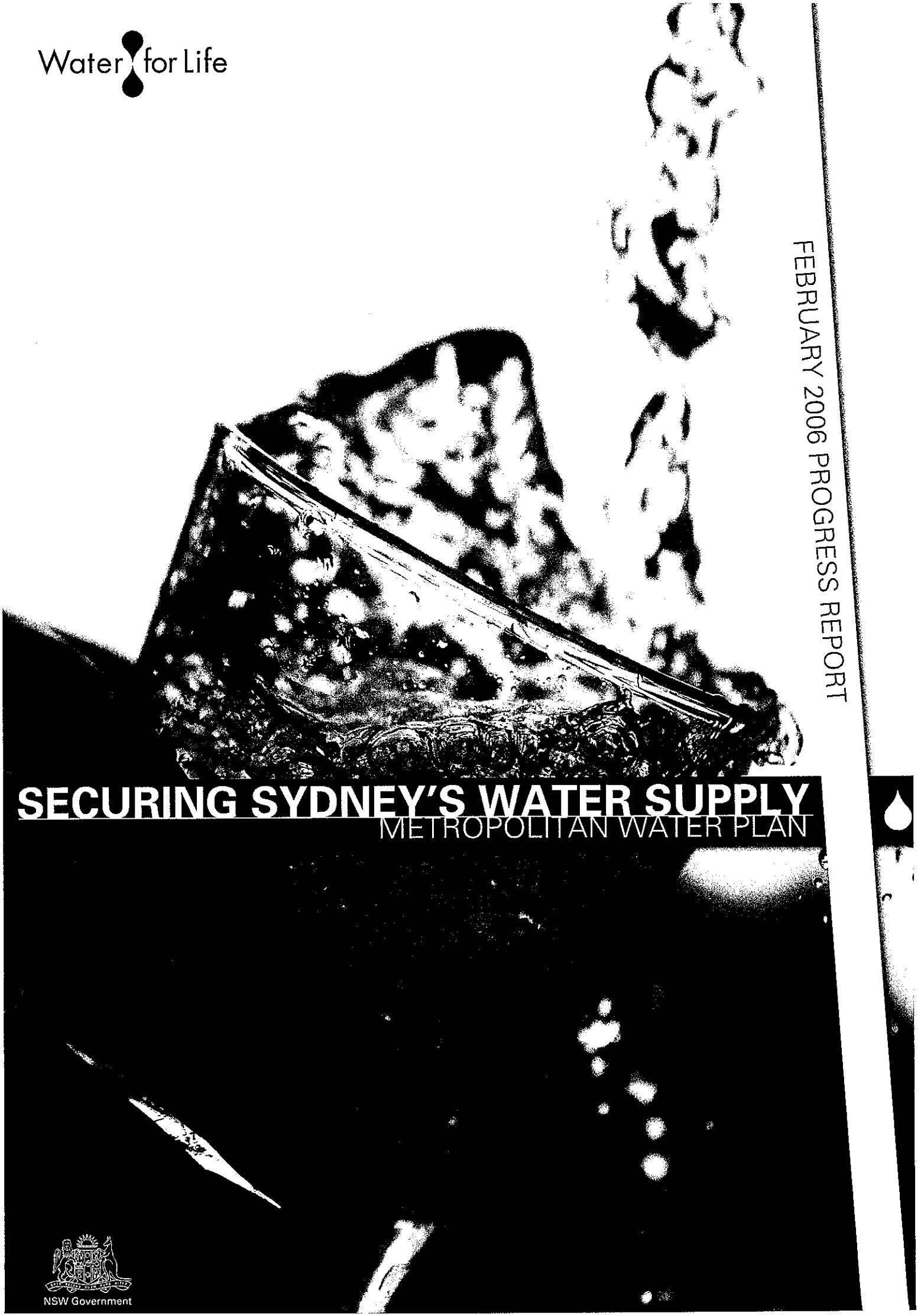
Yours faithfully

Morris Iemma MP
Premier

Encl.

LEVEL 39, GOVERNOR MACQUARIE TOWER, 1 FARRER PLACE, SYDNEY 2000, AUSTRALIA
TEL: (02)9228 5239 FAX: (02)9228 3935 URL: www.premiers.nsw.gov.au G.P.O. BOX 5341, SYDNEY 2001.

Water for Life



SECURING SYDNEY'S WATER SUPPLY

METROPOLITAN WATER PLAN

FEBRUARY 2006 PROGRESS REPORT

NSW Government

premier's message

Over recent years we have been through one of the most prolonged droughts of the last 120 years. We live in a dry country and drought is part of our lives. However, this drought is only comparable to the 1890s and 1930s.

During the last three years we have all played our part in securing Sydney's water supply for future generations and we want to continue to do so. Households, industry, the farming community and the Government have worked together on innovative programs to stop water wastage and put in place long term measures to better use our scarce water supplies.

I am pleased to present this progress report, which is based on several years work. Most importantly, we have had a new, independent analysis done of the various measures that are being put in place. This work was done by Professor Stuart White of the Institute for Sustainable Futures at the University of Technology, Sydney and Mr David Campbell, Executive Director ACIL Tasman, with technical support from the Snowy Mountains Engineering Corporation.

Their advice gives me confidence that Sydney is now in a position to secure its water supplies in the face of severe drought — and even potential climate change impacts — and has more than enough water to meet its normal growth needs for at least the next 10 years.

The key measures presented in this progress report include both those that will secure our ongoing water supplies during normal times and those that give us total security during periods of drought.

Professor White and Mr Campbell have noted the current trend of a slow climb out of the present drought. During this drought, the water levels in our dam system fell below 38%. They now stand at almost 45%.

We know for certain that the system's storage capacity will increase significantly in six months time, when a major project to access deep water from the Warragamba and Nepean Dams comes on line, providing an extra six months supply in this drought. This is an extra 40 billion litres per year of previously inaccessible water, or an extra 8%. We also know that the water efficiency measures now in place will together save 145 billion litres of water per year by 2015..

This gives us all comfort, but it is not enough. That is why we have spent the past year investigating major recycling projects, especially for industrial, agricultural and environmental purposes. In June this year we will issue Expressions of Interest for a major recycling project that will provide 27 billion litres of water each year to industry, new growth areas and to substitute for environmental flows in the Hawkesbury–Nepean catchment that would normally come from the Warragamba Dam.

The Government is also reviewing the results of a Registration of Interest for a recycling project at Camellia in Sydney's West which will contribute up to six billion litres each year and during 2006 we will examine another five recycling projects.

These projects together will save Sydney more than 55 billion litres of pure drinking water each and every year by the time they are all running at full capacity in about 2015. This will contribute greatly to securing our water supply into the future, bringing the volume of recycled water to more than 70 billion litres per year.

Water for Life

In recent months the Government has been consulting with the communities of the Shoalhaven region about the proposal to raise the Tallowa Dam wall to enable greater pumping of water from the Shoalhaven River into Sydney's dam system. Professor White and Mr Campbell have advised me that we do not need to proceed with that proposal at this time in order to secure Sydney's water supply. Instead, they have advised that we could change the way the pumping scheme operates, which would provide additional water from the Shoalhaven at low cost without raising the dam wall.

Two other factors now provide Sydney with absolute security in time of drought. The first is the discovery of major sources of high quality groundwater in the Southern Highlands. We are confident that this deep aquifer can provide at least 15 billion litres a year for three years. A further site in Western Sydney is showing promise for a further large reserve pending final technical research that is being conducted over the next few weeks. This gives Sydney a major buffer of supply of pure drinking water that it did not have in the past.

Finally, we are now in a position to build a desalination plant. Professor White and Mr Campbell have advised me that having the capacity to construct and operate a desalination plant is an essential part of securing Sydney's water supply. They have advised that having the ability to build a desalination plant within 26 months after reaching 30% of dam levels will deliver the security we require and drought proof Sydney.

Their finding that we can now secure our water supplies without building a desalination plant right now gives me confidence that this is a responsible course.

I will ensure, however, that we will always be ready to switch on a desalination plant well before Sydneysiders face dangerously low dam levels. That is why we have bought the site to build the plant, will continue with work to design the plant and will buy a final design blueprint. This will enable us to commission the plant within 26 months after awarding the contract, should it become necessary. If it does become necessary to construct and operate the plant, it will effectively be powered 100% using renewable energy, meaning it will have no net greenhouse impact.

This decision assures our long term water supply security, especially as the blueprint will include the ability to scale up the plant to produce more water should a future drought be severe and prolonged. It also means that we will never have to face water restrictions more severe than those currently in place.

I am pleased to be able to report this progress in our plan to secure Sydney's water supplies. Over the next few months I will release further information about our plans.

MORRIS IEMMA
PREMIER OF NEW SOUTH WALES
8 FEBRUARY 2006

In December 2005, the Government engaged independent experts to review the proposed approach to securing Sydney's water supplies and to advise on the effectiveness of the range of measures underway and proposed to ensure a balance between supply and demand. This work was done by Professor Stuart White of the Institute for Sustainable Futures at the University of Technology, Sydney and Mr David Campbell, Executive Director ACIL Tasman, with technical support from the Snowy Mountains Engineering Corporation.

Their advice has major implications for the proposed approach to securing Sydney's water needs, both in drought and for the longer term.

To summarise, key findings of their analysis include:

- Thanks to measures already implemented or underway, there is sufficient water available to securely meet Sydney's needs for at least the next ten years. These measures include significantly increasing recycled water use, accessing deep storage in our dams, improved water efficiencies and the discovery of significant groundwater reserves for use as a drought-proofing measure.
- It is not necessary to proceed with construction of a desalination plant at this stage. Having the capacity to construct and operate the plant within a known time period is sufficient to guarantee that Sydney's water needs can be met even during severe drought. Deferring actual construction of the plant until dam levels reach critical levels can deliver substantial financial savings, while fully guaranteeing security of supply for the first time.
- The capacity to construct and operate a desalination plant has extremely significant benefits for system security and flexibility. By creating a more diverse and non-rainfall dependent supply mix, the capacity to construct and operate desalination enables us to guarantee water supplies in drought, and allows us to make better use of our rainfed system.
- It is unnecessary to proceed with raising Tallowa Dam wall. However, implementing operational changes to the current transfer regime would deliver significant water volumes at low cost.

This crucial new information, together with the effect of new recycling and conservation measures agreed by Government, means that we now have more options available to secure Sydney's water supplies — both in the context of the current drought and for the longer term.

As a result:

- The Government has decided that it will not proceed to construct a desalination plant at this stage, but will be fully ready to construct a plant at short notice if dam levels drop to critical levels in future.
- The Government will continue to do the leg work necessary to ensure that it is able to proceed with construction in the event that severe drought conditions return and dam levels fall to critical levels.
- The Government will also undertake preparatory work to enable it to tap into newly identified groundwater resources in the event that the current drought worsens, or to help meet drought needs in the future.
- The Government has also decided that it will not proceed at this stage with raising Tallowa Dam wall. However, the Sydney Catchment Authority will investigate changed pumping rules for the Shoalhaven system that would optimise the way the system is used, but minimise river health impacts and ensure security of supply for Nowra and other South Coast communities.

Together, these new initiatives add up to a more sustainable and cost effective way to secure Sydney's water supplies, both for drought and the long term.

The Government's new approach is outlined in this Progress Report and further information will be provided in the 2006 Metropolitan Water Plan, to be released in March this year.

This Progress Report, together with the advice provided by the Government's independent consultants, can be accessed online at www.waterforlife.nsw.gov.au.

CHANGING CLIMATIC CONDITIONS

Drought is a normal climatic condition in Australia, but the current drought has been particularly severe, putting it on a par with the worst drought on record (1934–1942).

However, there are signs that drought conditions are easing. In 2003 and 2004 dam levels fell by 11% and 14% respectively. In 2005, dam levels continued to drop until they reached their lowest level of 37.9% in June. Since then, dam levels have started to recover and now stand at around 45%. Already this year, the system is up 3% on its level at the end of 2005, with reasonable prospects of further rises over coming months.

New data about the amount of water flowing into the storage system during the current drought has affected the long term average water availability data, effectively reducing the volume of water that can responsibly be drawn from the dams annually by 25 billion litres. However, this effect is more than offset by existing and new measures to reduce demand on storages.

In addition, the independent consultants' analysis shows that better data about projected water demand is likely to result in significantly lower demand in the future than was assumed in the 2004 Metropolitan Water Plan. While the more conservative approach adopted in 2004 is still being used for the sake of caution, the new information suggests that we could have a safety margin of around 40 billion litres a year by 2015.

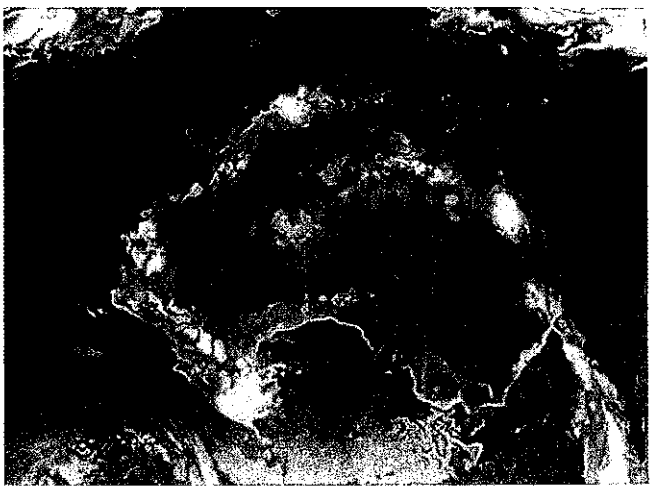
CLIMATE CHANGE

Climate change could alter rainfall and drought patterns in the future, but the nature and scale of climate change impacts are not yet known. For example, climate change could result in more intense and prolonged droughts, but could also lead to more intense storm events in the catchment.

The Government is undertaking a comprehensive study in collaboration with the CSIRO to better understand the implications of climate change for our water supply and demand balance. When the findings from this study are available in two years time, they will further inform development and implementation of the Metropolitan Water Plan.

The range of measures now in place and proposed, together with the Government's preparedness to build and operate a desalination plant if dams fall to critical levels, mean that we have the ability to secure our water supplies against severe climatic conditions, even if climate change impacts come to bear in the near term.

While recent rain has helped boost storage levels, the Government is also implementing a wide range of measures to augment supplies and reduce demand, which are outlined below.



RECYCLED WATER

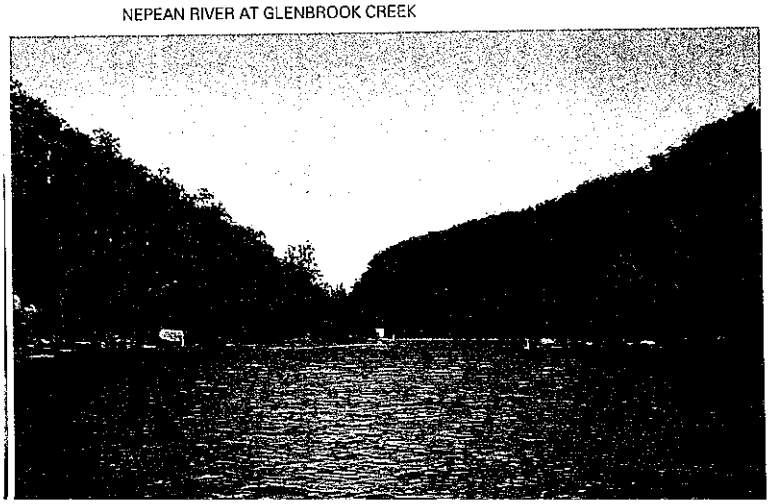
Recycled water is critical to achieving a sustainable and secure water supply for greater Sydney. Together with recycling projects already underway, the measures now proposed and under investigation will increase the amount of water currently recycled by more than 55 billion litres per year. This will take Sydney's total recycled water volume up to 65 billion litres by 2011, rising to more than 70 billion litres per year by 2015.

The Government is pursuing recycling wherever it is feasible and practical, but recycling is not the whole solution to Sydney's water needs. Many factors must be taken into account before committing to a recycled water scheme. These include cost (treatment and transport), environmental impacts and benefits (e.g. energy use and reducing pollutant discharges to rivers), potential health issues and community acceptance. Other criteria for a successful scheme include close proximity of users to the source of the treated wastewater and stormwater, long-term, guaranteed customers who are located close to each other, and the quality of the required recycled water.

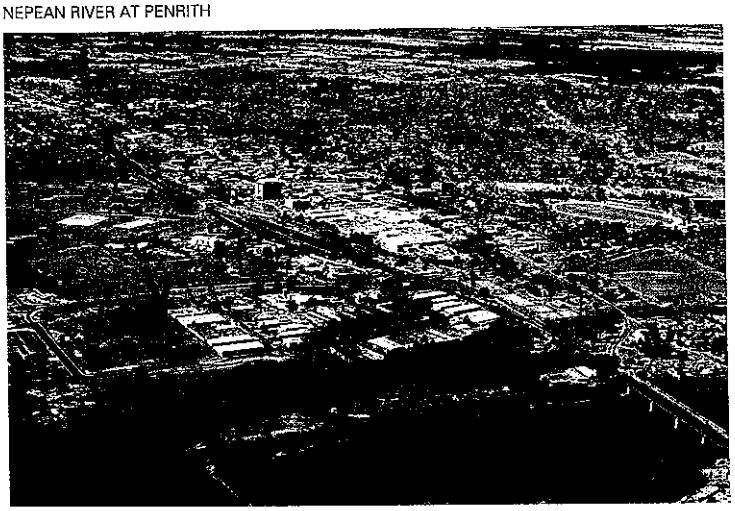
Government investigations have concluded that there are further recycling schemes that can now be implemented in Western Sydney and some established parts of Sydney.

WESTERN SYDNEY RECYCLING WILL PRODUCE 21 BILLION LITRES PER YEAR BY 2011 RISING TO 27 BILLION LITRES A YEAR

NEPEAN RIVER AT GLENBROOK CREEK



NEPEAN RIVER AT PENRITH



RECYCLING IN WESTERN SYDNEY

The Government has undertaken detailed planning into the construction and operation of a major Western Sydney Recycled Water Initiative. This is now in the final stages of development and an Expression of Interest will be issued to the market in June 2006. This is scheduled to be completed by 2009 and is expected to produce 21 billion litres of recycled water a year by 2011, rising to 27 billion litres a year by 2015.

The objective is to maximise the use of recycled water for industrial and agricultural purposes; to substitue for environmental flows in our rivers; and for use in new homes for non–drinking purposes (e.g. garden watering and toilet flushing). This will save a significant amount of pure drinking water from being used where such high quality water is not needed.

The North West will be the first area to use recycled water as a result of this project. There are already several high quality Sewage Treatment Plants in the region that will provide the recycled water. Future development plans for the South West are still being finalised but recycling projects will be implemented as development proceeds.

Key features of the North Western Scheme include:

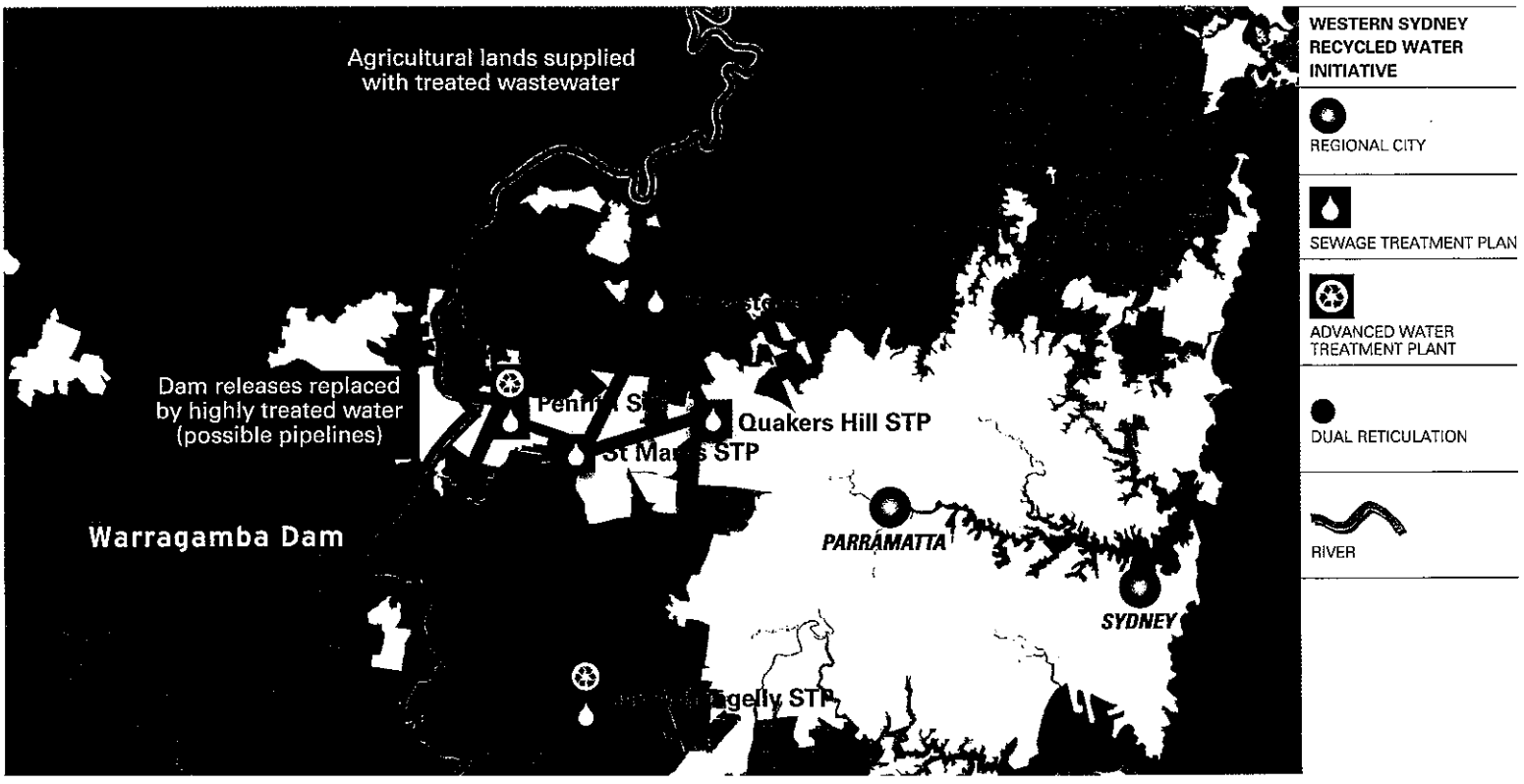
- The interconnection of the three existing Sewage Treatment Plants (Penrith, St Marys and Quakers Hill) to form an integrated source that can service demand for recycled water from new residential land releases;
- An Advanced Water Treatment Plant (drawing on the available wastewater at the above plants) to replace water currently released from Warragamba Dam for agricultural, domestic, stock and river health purposes; and
- An Expression of Interest to be released to the private sector in June 2006 for the delivery of the above services.

All of the treated wastewater currently being discharged by Western Sydney sewage treatment plants will be fully allocated to productive uses, producing about 27 billion litres of recycled water every year by 2015.

In addition, by removing large quantities of algae-causing nutrients currently being discharged by Sewage Treatment Plants, the scheme will deliver significant water quality improvements in the Hawkesbury Nepean River and its tributaries.

Over the next 25 years, the NSW Government is also committed to:

- Providing recycled water via dual reticulation to all 160,000 new homes to be built in new suburbs in Sydney's north west and south west;
- Substituting as much recycled water as feasible for planned environmental releases from Warragamba Dam; and
- Utilising treated wastewater for agricultural reuse as supply becomes available.



RECYCLING IN ESTABLISHED PARTS OF SYDNEY

The Government has also undertaken detailed planning into the construction and operation of smaller, more localised recycling schemes in built up areas of Sydney, utilising a range of recycling methods including sewer mining, stormwater harvesting and use of treated wastewater.

Recently, the Government called for Registrations of Interest from the private sector to provide a recycled water scheme at Camellia, near Parramatta. This area has large industrial water users that could use recycled water. It is estimated that the Camellia project could save up to six billion litres of drinking water every year with the possibility of further gains over the coming years.

There are other potential schemes located in Kurnell, Botany, Parramatta, Wollongong and the Royal Botanic Gardens. The Government is in the process of negotiating with key customers to assess the best means to progress these schemes, including issuing Expressions of Interest where appropriate.

REGULATORY REFORM TO SUPPORT SMALL SCALE RECYCLING

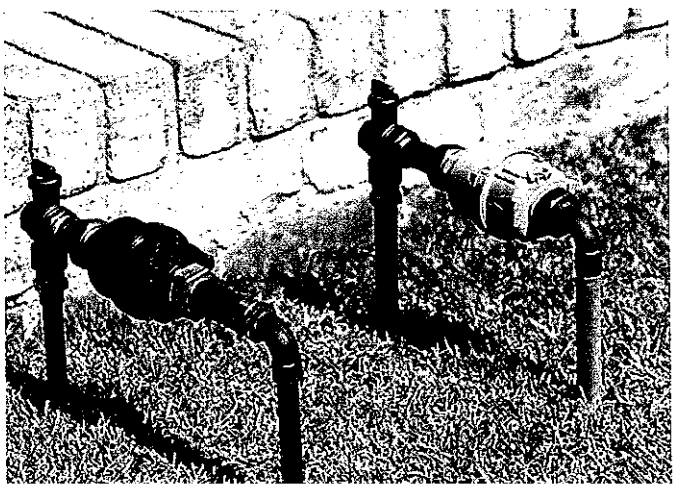
In addition to these recycling initiatives, the Government will institute a range of reforms to support the uptake of recycling at the local and household scale.

The Government will replace the current prescriptive approach with a more modern basis for managing the low risks associated with small scale recycling. Householders will no longer need to obtain council approval for directly diverting their grey water to the garden provided some simple conditions are met, and most small water recycling projects will no longer require an Environmental Impact Statement.

In addition, a streamlined regulatory framework for private recycling systems will be implemented. This will be based on standardised system operation guidelines, independent accrediting authorities, and a single lead agency to support the large number of councils and water utilities that have regulatory responsibility for installation and operation of these systems.

CONSTRUCTED WETLAND FOR STORMWATER MANAGEMENT

VIOLET PIPE SUPPLIES RECYCLED WATER FOR GARDENS AND TOILETS



WATER SAVINGS MEASURES

Improving water efficiency or 'demand management' is one of the best ways to reduce long term pressure on our water supplies, but can be especially beneficial during drought.

Like recycling and desalination, measures to improve efficiency are independent of rainfall. By saving a kilolitre of water through improved efficiency, we effectively leave that water in the dams, thus boosting available supplies. In this way, water efficiency measures help us to preserve our rainfed supplies in drought and reduce our reliance on other, more costly measures.

Water efficiency measures include programs designed to reduce total water use over time, and restrictions to reduce consumption in response to drought.

During the last two years, Sydney Water's customers have made great savings in response to the drought. Current restrictions have helped reduce our annual water consumption from 630 billion litres per year (prior to restrictions) to 520 billion litres per year now. It is important that we all continue to save water whilst the current drought persists.

In addition to restrictions, there are many programs designed to improve water efficiency and thus reduce consumption over time. Sydney Water has been implementing water efficiency programs since 1995. Their efforts in this area are world class. Since 1999, these programs have saved over 90 billion litres of water. They now save and will continue to save around 35 billion litres of water every year, equivalent to the annual water use of 138,000 households. These savings will continue to grow and are estimated at 65 billion litres per year by 2015.

In 2005, the Government established the $120 million Water Savings Fund ($30 million a year for four years). The Fund will be used to improve water efficiency, promote the uptake of alternative sources such as rainwater and recycled water, and stimulate investment in innovative water technologies.

The Water Savings Fund has been tremendously successful in attracting bids in response to its first funding round. Over 70 applications have been received, with bids for recycling and water efficiency projects.

A short list of successful applicants has been identified and will soon be announced. This first round of funding will allow projects to proceed that will deliver annual savings in the order of 14 billion litres per year by 2015. Such innovation will help us make the most of our existing water resources and improve efficiency in the longer term.

The Government also legislated in 2005 to require large water–using businesses, councils and Government agencies to prepare Water Savings Action Plans. These are due to be completed by March this year and should further promote efficiency across the business and government sectors.

Analysis undertaken by the Government's consultants shows that, together, these programs are projected to save around 145 billion litres per year of water by 2015, making a major contribution to balancing Sydney's supply and demand for water.

But there is even more we can do to achieve low cost water savings, and even save money on energy bills, without impacting our quality of life.

NEW WATER SAVING MEASURES

The Government has been investigating what further measures can be implemented and is pleased to announce five new water savings measures that will improve our supply-demand balance in the longer term and help conserve water supplies during drought.

As well as saving water, these measures help reduce the amount of energy required to move water and wastewater around our network, and the amount of energy required to heat water in our homes. As such, they help us save on our water and energy bills, and reduce greenhouse gas emissions.

The five programs that have recently been agreed by the Government will together save 14 million litres of water per day (5 billion litres of water per year) and help people and businesses to save on their water and energy bills.

The first of the five new programs involves retrofitting an additional 50,000 Department of Housing homes and units, bringing the total number of public housing properties retrofitted to 75,000. Together with Sydney Water's wider retrofit program, the total number of homes retrofitted will be 550,000 by 2008. As well as saving water (almost 3 million litres per day, or just over one billion litres per year), this program will help low income families to reduce the amount they spend on water bills.

Secondly, a rebate of $150 will be offered to Sydney Water's residential customers for one calendar year from March 2006 for the purchase of water efficient front loading washing machines. Such machines currently make up only 4% of washing machine sales. The rebate will help customers to choose an efficient machine over a less efficient machine and is expected to save one million litres of water per day across Sydney (365 million litres per year) once the program is fully implemented.

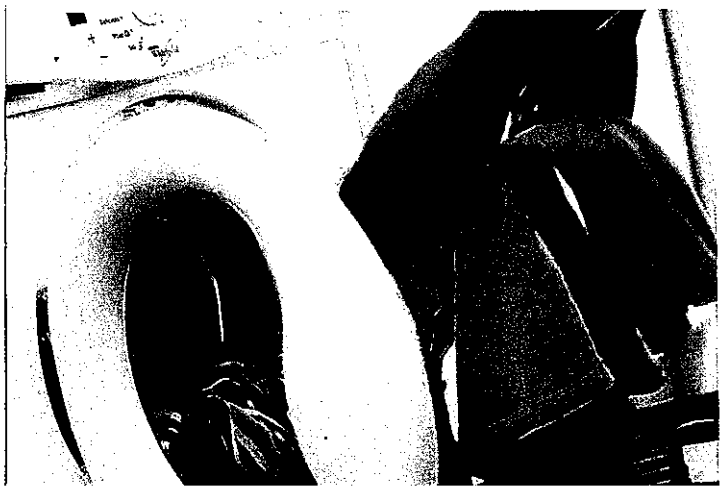
Thirdly, the Water Savings Fund will be increased by $10 million in 2006. This money will be used to assist high water–using councils and businesses to implement actions identified in their Water Savings Plans. This is expected to deliver savings of over nine million litres per day (3.4 billion litres per year), and is a highly cost effective way of reducing pressure on water supplies.

Fourthly, Government will implement significant programs in its own areas of responsibility. Sydney Water will help over sixty Government sites to improve their water efficiency, with water savings of 25–30% expected over two years. The focus will be on large water users, mainly hospitals, correctional facilities and TAFE campuses, and the program is expected to save nearly 3 million litres per day once implemented (just over 1 billion litres per year).

Lastly, Sydney Water will conduct a trial to help 20 government schools to improve efficiency by reducing leaks. This trial program could be expanded to all public schools, a total of 920 schools, if the program proves cost effective

Water efficiency measures reduce demand significantly compared with what would happen if no action was taken, thus creating a surplus of available water.

WATER EFFICIENT CLOTHES WASHER



SHOALHAVEN TRANSFERS SCHEME

Since 1976, the Shoalhaven River has been an integral part of Sydney's water supply during serious drought. The Shoalhaven Scheme has been used to transfer water to Sydney only three times since its construction 30 years ago. On average, that has only happened once every ten years.

Under the scheme, water is pumped from Tallowa Dam (at the junction of the Kangaroo and Shoalhaven Rivers) through a series of pipelines and reservoirs to either the Nepean or Warragamba dams.

In the present drought, pumping began when the total system storage was at about 60% (in 2003), and approximately 20% of Sydney's supply has since been sourced from the Shoalhaven River.

The Government's 2004 Metropolitan Water Plan set out plans to source more water from the Shoalhaven system. The rationale behind the proposal was to capture a larger percentage of water from the Shoalhaven River during periods when more water is available instead of waiting to commence transfers until the system is already experiencing low inflows.

The 2004 proposal sought to:

- Increase the total amount of water available to Sydney;
- Improve overall river health in the Shoalhaven; and
- Secure local water supplies.

The proposal for meeting these objectives involved:

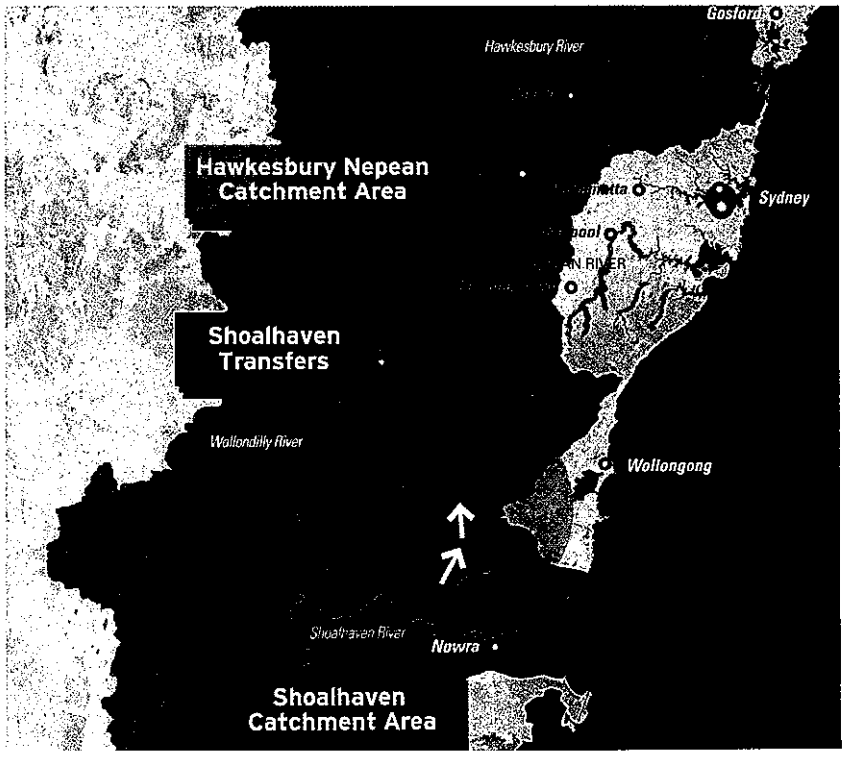
- Increasing the capacity of Tallowa Dam (through the installation of 21 seven metre radial gates on the existing dam crest);
- Increasing the volumes that can be transferred each day by replacing the existing transfer mechanism with a new large diameter tunnel from Burrawang pumping station to Avon Dam;
- Implementing new environmental flow rules governing the timing, quantity and quality of releases from Tallowa Dam.

Since the release of the 2004 Metropolitan Water Plan, the Sydney Catchment Authority, which operates the scheme, has been developing a detailed design of the proposal and, last November commenced a comprehensive community consultation process which is presently under way.

A scheme has been devised which could provide an additional 100 billion litres per year through major infrastructure works. However, the new analysis undertaken by the Government's independent consultants shows that Sydney is now in a position to secure its water supplies in the face of severe drought, and has more than enough water to meet its normal growth needs for at least the next ten years. In light of this analysis, it has been decided not to proceed with any immediate and significant modification to the Shoalhaven Transfers Scheme.

In the short term, the Sydney Catchment Authority will examine the potential for modest increases in the water available from the Shoalhaven through changed pumping rules and minor modifications to the existing transfer network. These changes can deliver some additional water without raising the Tallowa Dam wall.

SOME WATER MAY BE SOURCED FROM THE SHOALHAVEN BY CHANGED PUMPING RULES



This would see the SCA transferring additional water largely through the existing infrastructure by varying the frequency with which pumping occurs. The SCA will undertake an assessment of the works required to optimise the benefits of changing the pump mark.

Such changes to the way in which the system operates could enable up to 30 billion litres a year of additional water to be transferred from Tallowa Dam without raising the dam wall. Nevertheless, under the new regime, Lake Yarrunga (the lake behind Tallowa Dam) would not be drawn down below current levels.

The new regime would be interim until the Government's long term objective of minimising the use of rivers as conduits can be achieved. The security of water supplies for the communities of Nowra and other South Coast areas will be guaranteed under a Water Sharing Plan, which will shortly be released for consultation.

A new environmental flow regime will be put in place to protect the health of the Shoalhaven River. The current process of scientific and socio-economic studies and consultation (including with relevant Catchment Management Authorities) will continue, with a view to having a recommended regime ready for Government consideration at the end of the year.

ACCESSING DEEP STORAGES

As announced in the 2004 Metropolitan Water Plan, construction is well underway to modify the Warragamba and Nepean Dams so that water at the bottom of the dams can be accessed for the first time. Deep storage access will be in place by August 2006 at these dams. Together, these new works will cost $120 million and provide us an extra 40 billion litres of water per year. This is 10 billion litres or 33% more than the original estimate of 30 billion litres of water.

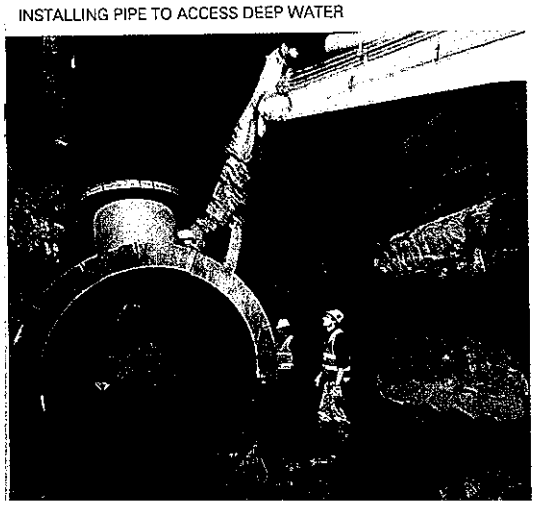
When the works at Warragamba and Nepean come on line in August this year, they will increase the capacity of the storage system by 8%.

DROUGHT PROOFING MEASURES

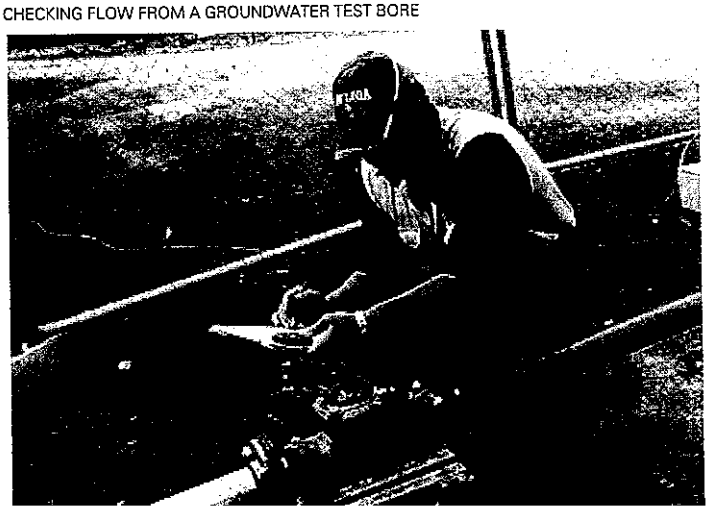
Access to deep storages will increase the water available to Sydney in the current drought, as well as in the longer term. In addition, measures that improve our water efficiency and increase the share of recycled water used in Sydney will help to slow the rate at which dam levels fall in times of drought. However, independent advice shows that these measures alone are not sufficient to guarantee Sydney's water supplies in the event of very severe and prolonged drought conditions.

Outlined below are two measures which will secure our supply system — even in the face of prolonged and severe drought. The Government's independent consultants advise that having the ability to tap groundwater resources during drought will increase security. Furthermore, having the ability to construct and operate a desalination plant, if required, provides the opportunity to drought proof our water supply system for the first time. This is a major achievement.

INSTALLING PIPE TO ACCESS DEEP WATER



CHECKING FLOW FROM A GROUNDWATER TEST BORE



NEW GROUNDWATER RESOURCES

In the 2004 Metropolitan Water Plan, the Government committed to a thorough investigation of the potential for groundwater sources to play a significant role in securing Sydney's drinking water supply during periods of severe drought.

Until now, groundwater sources in Sydney's hydrological catchments have not been studied extensively or systematically.

Over the past year the Sydney Catchment Authority (SCA) has carried out a major study examining potential groundwater reserves in a number of sites around the catchment. The study has involved deep drilling to levels of more than 200 metres through the Hawkesbury sandstone at seven key sites.

The SCA study will be completed in the middle of the year, but it has already identified one major groundwater reserve in the Upper Nepean and there are encouraging early results from a further trial near Leonay in Western Sydney.

The Upper Nepean deep groundwater source is located near Kangaloon in the Southern Highlands. Findings to date suggest a high quality water source capable of providing up to 15 billion litres per year for up to three years at a time during drought, with a range of five to seven years for the resource to recharge.

A potential bore field in this site would cover 50 to 100 square kilometres and would:

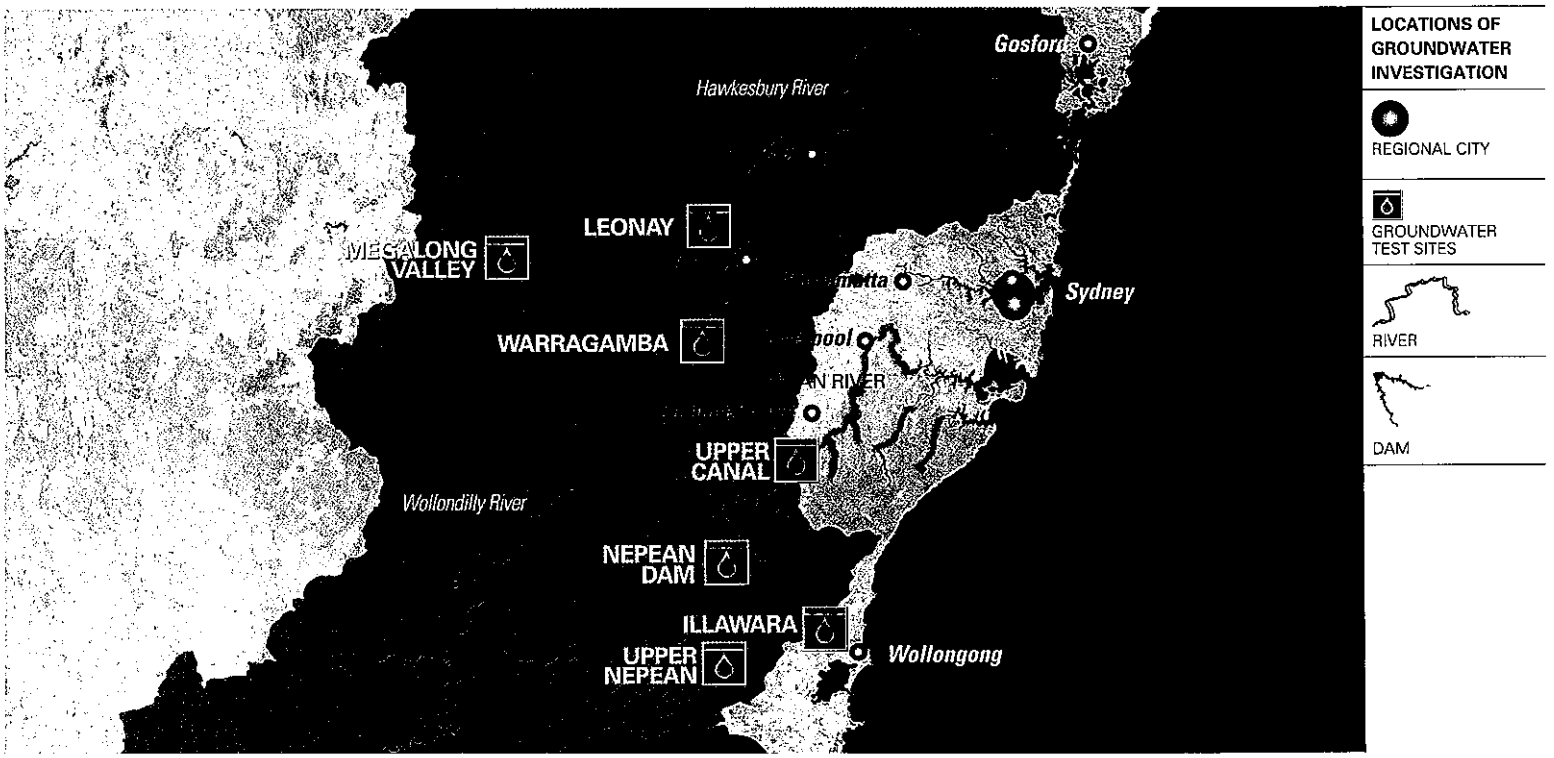
- Be within SCA owned lands;
- Produce water of extremely high quality;
- Have bore locations and connecting pipelines that are close to flowing streams that can be used to deliver water to either Avon Dam or Nepean Dam;
- Represent the first significant development of deep groundwater in the catchment (most existing groundwater extraction comes from shallow aquifers); and
- Would take about two years to fully construct (with bores coming on line progressively from six months into the construction phase) at a cost of $40–50 million, providing around 50 bores with five discharge points.

While drilling is less advanced at Leonay in Western Sydney, early signs suggest that something in the order of 15 billion litres per year could be achieved.

Together, these two sites may well contribute a minimum of 30 billion litres of additional water a year for a period of three years during a prolonged drought. This will provide a major source of drought-proofing, securing Sydney's water supply during the next drought.

The SCA will have completed its studies by June this year. It will publish a detailed report on the potential of these groundwater resources and the issues associated with their sustainable management.

This report will be released for community comment to assist the Government in making a final decision later this year. The Government intends to fast-track the design and environmental assessment process for this project so that it has the capacity to construct it in time if the current drought worsens, or for the next major drought.



DESALINATION— SECURING OUR WATER SUPPLY

The Government announced in the 2004 Metropolitan Water Plan that we would undertake detailed planning and design to ensure that, if the drought were to continue beyond 2006, a desalination plant could be constructed relatively quickly and efficiently.

This work confirms that desalination is a viable means to boost water supplies. It underlines the advice of our independent consultants that maintaining the ability to bring in desalination capacity within a short time frame is an essential element of our plan to provide absolute security for Sydney's water supplies.

The Government's independent consultants have advised that the ability to construct and operate a desalination plant is a necessary component of a multifaceted plan to secure Sydney's water supplies.

Their analysis shows that the capacity to build and operate a desalination plant in the event of a severe drought has extremely significant benefits for system security and flexibility. By creating a more diverse and non–rainfall dependent supply mix, the capacity to construct and operate a desalination plant enables us to guarantee water supplies in drought and allows us to make better use of our rainfed system.

Considerable work has now been undertaken. As of February 2006, we have undertaken detailed environmental and engineering assessments, procured a site at Kurnell, applied for planning approvals, consulted with the community and are ready to commence pilot testing.

The work that has already been done has shown us that desalination can be deployed to secure Sydney's water supplies during drought. This has shaved 12 months off the lead time that would otherwise be required to deploy this option. This extensive preparatory work will have involved an investment of $120 million by November this year.

This is the price we must pay to have the capacity to commission a desalination plant if we need it during a prolonged drought. According to the Government's independent consultants, however, a decison not to proceed with construction of the plant until required offers a significant financial saving. This is estimated to be close to $1 billion, relative to proceeding immediately to build.

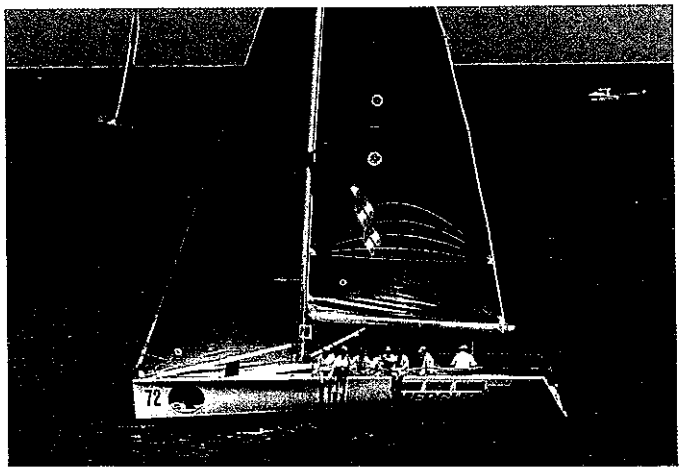
The Government is now confident that, having finalised the design blueprint and approvals, construction of the desalination plant can be achieved within 26 months of awarding the contract, should it become necessary in the event of prolonged drought.

A desalination plant will be built if, in future, critical dam levels of around 30% are reached. But this has an extremely low probability, because of our considerable storage capacity and the mix of other measures that we now know can help secure our water supply, including new recycling capacity and groundwater resources.

The consultants' analysis shows that, because we have done the leg work, we have the capacity to construct and operate a plant within 26 months after the decision to award the construction contract. Such a capability effectively secures our water supplies against the possibility of severe drought conditions returning.

That is, proceeding with actual construction of the plant now is not required in order to guarantee that Sydney has sufficient water to meet its needs, even in severe drought.

The new groundwater resource means that high quality, cost–effective water is available to slow dam depletion rates in the event that severe conditions return. This would further delay the point in time at which critical levels would be reached, and thus the point at which it would be necessary to start building the desalination plant.



This is a starkly different picture from the situation we confronted in 2005, when dams reached their lowest ever point, after two years of steeply dropping storage levels.

However it is important that we be ready to build the plant. As such, the Government will continue with a program of preparatory works — including completing detailed design work by the end of 2006 — but will not proceed to engage tenderers to construct the plant at this stage.

If severe drought conditions were to return immediately, and dam levels fell rapidly rather than recovering as they are currently, then the Government would implement the following plan:

- Proceed to construct the groundwater borefield at around 40% storage levels, thus using it as the first line of defence against ongoing drought conditions and providing the planning time to commence construction of a desalination plant. The first bores would be operational within six months and the full network would be in place in two years.
- Award construction contract for the desalination plant at around 30% storage levels, so as to ensure that the plant is built and operational 26 months later, well before storages would fall to critical levels.

The likelihood of such severe conditions returning immediately and continuing for several years in succession is very low.

However, we all know that climate change may alter rainfall patterns. This is one of several reasons why it is important that the Government must be in a position to deal with even this contingency should it arise, and why we will be ready to build a desalination plant at short notice if required.

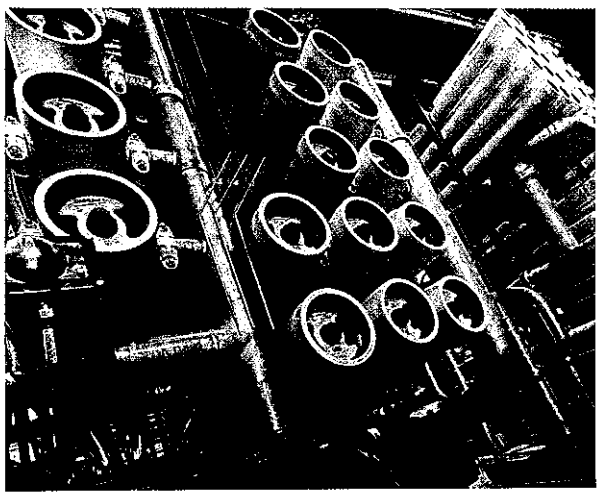
In the event that construction is necessary, the Government has decided that the desalination plant will effectively be powered using 100% renewable energy. This would mean that the plant would have no net greenhouse impact. Further details on how this will be achieved will be announced shortly.

Deferring construction of the plant can also deliver very significant financial savings, thus avoiding extra costs to consumers until absolutely necessary.

The cost of having, for the first time, the ability to guarantee Sydney's water supply in extreme drought is around $120 million. Of this, $94 million has already been provided for in the current Independent Pricing and Regulatory Tribunal (IPART) price determination (for the period October 2005 to June 2009). Additional costs would only be incurred should extreme and sustained drought conditions require construction of a plant. For example, the actual construction and operation costs of a 125 million litres per day scaleable plant, if incurred, would raise customer bills by around $60 per year.

Having the capacity to construct and operate a desalination plant to secure supplies during severe drought means that we would never need to impose restrictions beyond those that have been in place during the current drought.

DESALINATION IS AN ESSENTIAL PART OF SECURING OUR WATER SUPPLY



In December 2005, the Government engaged independent experts to review the proposed approach to securing Sydney's water supplies and to advise on the effectiveness of the range of current and proposed measures to ensure a balance between supply and demand.

As we have seen, the advice provided by the Institute for Sustainable Futures, ACIL Tasman and the Snowy Mountains Engineering Corporation has important implications for the approach to securing Sydney's water needs, both in drought and for the longer term.

With recent rain, and the wide range of measures implemented by Government, dam levels are substantially improved compared to the situation in mid 2005. When deep water access comes on line later this year, we will have even more water to see us through the current drought.

This is a major change from the situation that confronted us in June 2005, and allows us to adopt a new and more flexible approach. Our new, multi-faceted approach will deliver significant financial savings, but without sacrificing security of supply.

Thanks to the work done since the release of the 2004 Metropolitan Water Plan, we are now in a position to build a desalination plant within a short period of time if required. This means, together with other measures now in place, we can 'drought proof' Sydney for the very first time.

Investigations into available groundwater resources mean we have other new options to respond to drought that were not available to us in the past. As well, new recycling and water efficiency measures will further reduce pressure on our rainfed supplies, and contribute to a more diverse water supply system.

As a result, we can confidently secure our water supplies in the face of severe drought, but avoid spending money on actual construction of a desalination plant until dam levels reach critical levels.

Of course, it is important to remember that while drought conditions have eased, it is still important that we all continue to save water. However, we no longer face the prospect of having to impose further restrictions since we now have other options available to help us through even the most severe drought conditions.

More information about our new approach will be provided in the 2006 Metropolitan Water Plan, which will be released later this year.

This Progress Report, together with the advice provided by the Government's independent consultants, can be accessed online at www.waterforlife.nsw.gov.au.

institute for sustainable futures
UNIVERSITY OF TECHNOLOGY SYDNEY

ACIL Tasman
Economics Policy Strategy

Mr Roger Wilkins
Director-General
NSW Cabinet Office
GPO Box 5341
SYDNEY NSW 2001

Dear Mr Wilkins

We are pleased to be able to provide the attached report of our review of the Metropolitan Water Plan. A further report with the results of additional, more detailed analysis will be provided at the conclusion of the review process.

This report reaches some strong conclusions – with substantial implications for the strategy. Several things combine to offer a much more positive outlook than would have been supported even a few months back:

- Recent rains have added substantially to water in storage. Combined with the current investment in accessing deep water, storage is now close to 50 per cent of expanded system capacity.
- Newly identified groundwater reserves offer good prospects for adding an additional and valuable instrument to the measures available for drought response.
- Significant new volumes of recycled water are now in prospect and can be expected to grow, adding to both supply and supply diversity.
- The substantial investment that has been made in establishing a viable desalination strategy has delivered the capability to introduce and use desalination in a deep drought with modest lead times – creating the opportunity to bring desalination in when needed, but in the meantime to avoid substantial costs.
- The investment in water saving by Sydney Water is already saving significant volumes of water. The NSW Government initiatives, including regulatory and pricing measures mean that savings will increase over time.

The analyses we have undertaken, factoring in these developments, lead to a number of important conclusions set out in our report. In particular, we would like to draw your attention to the following:

- Measures already implemented or approved point to a secure supply system – with supplies in excess of demand using no more than the present level 3 restrictions – until at least 2015.
  - This conclusion is crucially dependent on these measures, and the way that some will progressively increase in impact over time – without them, supplies would not be secure.

Mailing address: UTS PO Box 123, Broadway NSW 2007
Street address: Level 11, UTS Building 10, 235 Jones Street, Ultimo NSW 2007
Tel 61 2 9514 4950 Fax 61 2 99514 4941 E-mail isf@uts.edu.au Web www.isf.uts.edu.au

- Beyond 2015, the water demand-supply balance could change substantially as a result of population growth and decisions your Government has yet to take on river flows, while climate change trends may have an impact on rainfall in the catchment (negative or positive).
  - We have identified a range of measures that could be implemented to meet these needs.
  - The right 'package' will depend on the needs that emerge and on earlier decisions taken on matters such as desalination. It is not necessary, and would almost certainly prove costly, to lock into a specific set of responses now.
- This approach to managing the system and system investments adaptively offers scope for large cost savings and for delivering a system better suited to future needs and available technologies.
- In contrast to the past, it is now possible to guarantee supply adequacy through any drought.
  - Access to water supplies that are largely independent of rainfall, such as from recycling, and scope for introducing, and if necessary scaling up, desalination in the event that dams fall to levels that threaten supply, combine to allow this to be done.
  - Importantly, the short lead times that have now been established for the construction of desalination, and the fact that the plant can operate in the middle of a drought, mean that it is not necessary to build the desalination plant yet – and it is unlikely to be necessary for many years.
  - However, it will be essential that the capability to deliver a desalination plant with short lead times, of the order of 2 years, be maintained and this will require some on-going investment.
- The promising groundwater sources could be exploited to further reduce the likelihood of needing desalination in the near term and to lower the overall costs of a drought response strategy.
- Delaying the physical construction of the desalination plant in this way offers very large financial savings.
- We have probed the robustness of these conclusions by simulating successive years of low rainfall much worse and less probable than any events on record and believe the conclusions broadly hold. Key risk factors that would sensibly be monitored and incorporated into the adaptive management of the system include:
  - per capita demands; the available evidence strongly suggests that underlying demand levels are lower than was assumed in the 2004 Metropolitan Water Strategy, but the above conclusions hold even at those levels. Any trend towards higher levels would need to be managed carefully or could trigger significant additional costs.
  - catchment rainfall and inflow patterns, that are the subject of considerable current research that should inform future reviews of the overall strategy;

We trust that this report is of assistance to your Government in this important planning process.

Yours sincerely

Stuart White
Institute for Sustainable Futures
University of Technology, Sydney

David Campbell
ACIL Tasman

Review of the Metropolitan Water Plan

February 2006

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Contents

Executive summary

This report forms part of a review of the Metropolitan Water Plan 2004 and contains findings regarding Sydney's supply-demand balance for water, both in the immediate and longer term. This review was commissioned by the NSW Cabinet Office, and is being undertaken by the Institute for Sustainable Futures at the University of Technology, Sydney and ACIL Tasman with technical advice from SMEC Australia. A further report with the results of additional, more detailed analysis will be provided at the conclusion of the review process.

Key findings

The key findings include the following:

- the immediate drought threat to Sydney's water supply is now manageable, due to the success of currently implemented measures and the development of new approved measures;
- this supply-demand balance is improved by the recent rain in catchment areas which has increased storage levels from a low of 38% in June 2005, to 45% at the present time – with the latest hydrology modelling suggesting a greater than 80% likelihood that storage levels will rise in the next 12 months (by contrast, in mid-2005, projections were that storage levels could be as low as 33% in February 2006);
- uncertainty regarding the immediate to medium term implications of climate change for catchment rainfall patterns must moderate this assessment, and there is inevitable uncertainty associated with hydrological modelling and input assumptions; however, our major conclusions would remain intact even with a much lower chance of improvement, and options exist for managing climate change risk in a way that still ensures supply security;
- the first tranche of investment in accessing previously unavailable water at Warragamba and Nepean storages, due to be available by August this year, will expand dam capacity by about 8% and implies that dam supplies are now effectively close to 50% per cent of this expanded capacity;
- further to this analysis of the current situation, there is adequate supply availability with very high security until at least 2015, based on existing and approved measures to increase supply availability and to reduce the demand for water, many of which have been, or are being, implemented since the 2004 Metropolitan Water Plan;
- it is estimated that the supply availability – the 'safe' volume of annual drawdown from the dam system – will be 580 GL/annum[1], while the unrestricted demand is estimated to be less than 560 GL/annum in 2015, due to a range of recycling and water saving initiatives that are in place or have been approved;
- demands on the system, including from growth and from possible changes to environmental flow requirements, could result in a significant increase in demands from 2015; there is a range of options available and sufficient to manage the supply-demand balance in the period 2015 to 2030, with sufficient time to choose the best strategy;

[1] Note that 1 gigalitre per annum (GL/a) is equivalent to 1 billion litres per year

- in addition to the underlying rain-fed system of dams, there is a greatly increased diversity and extent of supply and demand options, including increased demand management, increased effluent recycling, the potential for groundwater extraction and the ability to bring desalination capacity on in a relatively short time (26 months);
- the ability to construct desalination capacity in a short time is the result of the planning, approval and testing processes that are completed or under way, which collectively have reduced the lead-time to construct by at least 12 months. This readiness greatly increases supply security by allowing a plant to be constructed and started in a drought in sufficient time to avoid breaching security requirements;
- as a result of the initiatives that are in place, and recent inflows to storages, there is no requirement to construct the desalination plant at this time, the ability to construct a plant of 125 ML/day upgradeable to 500 ML/day within a 26 month period provides sufficient security;
- even more fundamentally, the substantial investment that has already been made in developing a feasible desalination strategy, alongside the roll-out of substantial recycling, allows a dramatic shift in the way that water supply planning should be undertaken, and drought risks can be managed;
    - in the past, drought risk management has depended overwhelmingly on pre-emptive investment in dam storage *in advance of* any drought –with dam construction during a drought offering little immediate benefit. Extreme droughts have always threatened the need to introduce very strong and potentially costly (Level IV and Level V) restrictions;
    - in the future, there will be scope for effective system augmentation within deep drought conditions, and pre-emptive investment, especially in desalination, would probably involve unnecessary costs with few if any offsetting benefits; access to these new options can fully replace the traditional role of Level IV and Level V restrictions and deliver additional security;
    - the major driver of Sydney's water planning is not the inadequacy of average rainfall, or even frequent droughts, but rather the risk of a rare but prolonged and deep drought. For Sydney, the current drought appears to be the second worst on record, second only to the drought of the 1930s/40s, with the drought in the 1890s being the only other recorded drought of comparable depth;
    - the ability to exploit this rarity, to limit infrastructure costs while still delivering absolute security, is a strength of this new approach to supply and drought planning;
- there is a very low probability of storages reaching the levels required to trigger the building of a desalination plant in the next four years – and even in the next ten to fifteen years.

Key periods of analysis

There are three key periods of analysis in terms of the supply-demand balance. Firstly, the immediate term – that is, the period up to the time when dam levels return to pre-drought levels. Secondly, the medium term, up to 2015, when decisions are to be made on environmental flow releases from Warragamba Dam which are likely to reduce supply availability. Thirdly, the period from 2015 to 2030, which is

when this policy decision would have an impact, and the period in which population growth is likely to have a greater impact on demand levels. The key issues associated with these three periods are summarised in the following paragraphs.

Immediate drought response

In addition to water restrictions, there has been considerable progress in the development of drought response measures:

- deep water from Warragamba and Nepean Dams will be accessible in August 2006, providing an impact on supply availability both for the current drought and for the future;
- a site for a desalination plant has been acquired and the approvals process and pilot testing is underway, which will effectively reduce the remaining lead-time to construct to less than 26 months, providing the capacity to construct and to supply water, and even to scale up, in sufficient time should dam storages drop to low levels;
- groundwater sources that could provide 15 GL of water a year in drought have been confirmed, with other sources with good prospects for offering a further 15 GL/annum under investigation; in both cases, access would be subject to environmental assessment. These sources would not offer indefinite supply, but appear likely to be subject to fairly rapid recharge and could push back considerably the time until construction of a desalination plant is needed.

These measures, plus the recent inflows to storages from rain events, means that there is a greater level of security for the water supply system than was the case at the time of the release of the 2004 Metropolitan Water Plan. Specifically, the ability to construct desalination capacity within a 26 month period, will mean that security is assured, even in the very unlikely case that storages fall to levels of less than 25%.

Medium term outlook

In the highly likely event that the storages reach pre-drought levels in the next 2 years, the period until 2015 will be marked by the continued implementation of a recycling strategy that will reduce demand from storages by 17 GL/annum, based on existing and approved projects. Further projects are proposed, which would have the effect of augmenting supply availability by 18 GL/annum.

In addition, a range of water saving measures are in place, including the roll-out of BASIX, the new Water Savings Fund and proposed changes to water pricing. These recycling and demand reduction measures, combined with the impact of Sydney Water's existing water savings program, which is the largest and most successful in Australia, are estimated to reduce demand by over 160 GL/annum in 2015. The demand is expected to be approximately 560 GL/annum, once restrictions are lifted (current demand, with Level III restrictions in place, is 520 GL/annum).

The available supply, including the impact of accessing deep water, but allowing for the environmental flow releases for the Upper Nepean, is expected to be approximately 580 GL/annum. This figure is based on either maintaining the ability to invoke Level IV and V restrictions, as is current policy, or to substitute these restrictions with the capability to construct and operate a desalination plant if dam levels reached very low levels.

Longer term outlook

The period from 2015 to 2030 is when any decision on environmental flow releases from Warragamba Dam would take effect and reduce the supply availability. This would also combine with the impact of increasing population on demand, as the current suite of low cost water saving and recycling measures reach their limit. There is a range of options available to meet the supply-demand balance at that time, including options currently being investigated to increase supplies from the Shoalhaven, as well as increased recycling and possibly desalination as a source of growth water, rather than the immediately envisaged security role. In the low likelihood event that the lack of short-term or medium-term rainfall does trigger a need for investment in a desalination plant, subsequent use of the capacity as a source of growth water may well prove cost effective because the capital costs will then be sunk and unavoidable. Its marginal costs of operation are likely to be competitive with the full costs of introducing new sources of supply.

There is ample time to consider these needs and options in detail and determine the best long-term strategy which meets the needs of the community at the lowest economic, environmental and social cost. There is also an opportunity to ensure that there is an appropriate level of community engagement in the decision making process, commensurate with the importance of these decisions.

1. Introduction

This report forms part of a Review of the Metropolitan Water Plan 2004 (DIPNR, 2004). and the principal factors that have changed since the Plan was released. Section 2 describes in more detail the immediate drought context and response and then Sections 3 and 4 explore the status of water supply and demand respectively. The supply-demand balance in the medium term (2006–2015) and longer term (2015–2030) is then evaluated in Section 5. Section 6 looks in more detail at how desalination might best be integrated into the strategy, before presenting conclusions in Section 7.

The focus of this report is on the supply-demand balance and how this is affected by changes that have occurred since 2004. A further report with the results of additional more detailed analysis will be provided at the conclusion of the review process.

1.1. What has changed since 2004?

Several factors have changed since the Metropolitan Water Plan 2004. These provide the basis for a more optimistic assessment of the ability to meet Sydney's supply-demand balance both now and to 2015.

These factors include:

a) increases in dam levels from a low of 38% in June 2004 to 45% in February 2006 with an 80% likelihood that dam levels will rise in the next 12 months (Sydney Catchment Authority estimate), although there is inevitable uncertainty associated with hydrological modelling and input assumptions. This lowers immediate and medium term risks to supply shortages and extends the time horizon in which decisions can be taken that affect longer term prospects;

b) improved understanding of demand and demand trends (discussed further in Section 4) that suggest underlying per capita demand is likely to be lower than the figure previously used;

c) a range of measures being implemented, in addition to the increasing impact of Sydney Water's demand management programs, that contribute to reducing actual demand including the roll-out of BASIX, the Water Savings Fund, stepped-tariff pricing, Water Savings Action Plans, Water Efficiency Labelling Scheme (WELS) and a range of new water saving initiatives;

d) significant progress in developing and implementing committed and approved recycling schemes which will reduce the demand for potable water by 17 GL/annum (further measures have been proposed that would augment supply availability by 18 GL/annum);

e) better modelling of the supply system including the incorporation of recent drought data;

f) diversification of supply options, including recycled water, groundwater and the capability to construct and operate a desalination plant within a relatively short period which allows for a more flexible approach to planning.

2. Drought context and response

The immediate drought threat has begun to ease due to the increased rainfall in catchment areas and the reduction in demand due to drought restrictions. SCA estimates that there is an 80% chance that dam levels will rise above their current capacity of 45% in the next 12 months.

Assuming that dam levels do now trend towards pre-drought levels, this drought will be remembered as the second worst on record from the perspective of the Sydney catchment. The drought from the mid-1930s to mid-1940s was slightly worse – and would, if repeated recently, have driven dam levels a little lower. The overall pattern of the two droughts is quite similar. The only other drought on record of broadly comparable severity was that of the 1890s.

Access to deep water in the Warragamba and Nepean storages will become available in August 2006. Current supplies inclusive of this deep water are close to 50% of this expanded supply capacity.

Groundwater sources that could be used to provide 15 GL/annum of water during drought have been confirmed, with the potential for an additional 15 GL/annum identified. These cannot be run indefinitely – offering indicative supplies at this rate for up to three years, followed by about 7 years recharge time. However, they are illustrative of a persistent theme through the present review. A gigalitre of water available when supplies from other sources are very low has much greater value – 'punches above its weight class' – than does a gigalitre of rain-fed supply. The strategic value of such water, in limiting risks, extending supplies and possibly allowing the deferral of high-cost infrastructure investment can be considerable.

The ability to construct desalination capacity in a short time (26 months) is the result of the planning, approval and testing processes that are almost completed, and which collectively have reduced the lead-time to construct by at least 12 months – to about 26 months. This readiness greatly increases supply security by allowing a plant to be constructed and started late in a deep drought in sufficient time to avoid breaching security requirements. This in turn limits the risks of committing to a high cost construction project, only to have the drought break, with adequate supplies still in storage – effectively resulting in a wasted investment.

These measures, plus the recent inflows to storages from rain events, mean that there is a very substantially greater level of security for the water supply system than was the case at the time of the release of the 2004 Metropolitan Water Plan. Specifically, the ability to construct desalination capacity within a 26 month period, will mean that security is assured, even in the event that storages fall to levels of less than 30% – an event with an extremely low probability based on the latest hydrological modelling, even with an allowance for significant change in risks due to climate change.

It is notable that, probably at the end of the second worst drought on record, dam levels have not fallen below 37.9 per cent of capacity and that methods have been developed that would allow a much deeper drought to be managed. Drought continues to be a serious risk for Sydney, and careful risk management is crucial – but in many respects this recent history, which has not required the imposition of Level IV or Level V restrictions, should be viewed as pointing to the robustness of the established system as well as to the value of sound planning.

3. Supply availability

The supply availability of water is determined by the inflows to dams, the ability to transfer water from neighbouring catchments, the restrictions rules that are employed and the availability of non-rain fed supply options (Erlanger and Neal, 2005).

The supply availability accepted at the time of the development of the Metropolitan Water Plan 2004 was 605 GL/annum. This has since been modified in the following ways:

- the recorded inflows which are used to calibrate the supply availability model (WATHNET) have been extended by 6 years to include the years up to 2004, which has the effect of reducing the modelled supply availability by 25 GL/annum – effectively the frequency of deep drought in the historical time series on which the model is based has been increased;
- a range of other changes to the WATHNET model have been made to model more accurately riparian releases at Tallowa Dam, environmental releases at several smaller storages and hydropower releases. Collectively these changes reduce supply availability by 15 GL/annum;
- the approved environmental flows for the Upper Nepean reduce the supply availability by approximately 25 GL/annum;
- accessing the deep water in Warragamba and Nepean storages increases the supply availability by 40 GL/annum, up from the estimate of 30 GL/annum in the 2004 Metropolitan Water Plan.

All of these changes or initiatives have been implemented or are in the process of being implemented, and their collective impact is to reduce the supply availability to approximately 580 GL/annum. This estimate does not include a number of proposed initiatives that would result in an increase of the available supply, namely:

- the capability to construct and operate a desalination plant in deep drought;
- the potential for increasing transfers from the Shoalhaven by increasing the trigger level for these transfers from 60% of system storage levels to 80%;
- the availability of groundwater resources that have been, and are, currently being investigated;
- the impact of return flows from the proposed Western Sydney Recycled Water Initiative;
- the ability to relax the strict requirements regarding frequency of low level restrictions.

These possibilities are described in more detail below.

This supply availability is based on the application of a set of rules that are defined in the Sydney Water Drought Response Management Plan (Sydney Water, 2003a:29) and includes the very low probability of requiring Level IV and Level V restrictions. This requirement is able to be offset by the capability to construct and operate a desalination plant in deep drought as described in Section 6.

As described in Section 2, groundwater resources offer a source of water that is accessible during drought periods. The more certain groundwater resources (15 GL/annum) in the Upper Nepean, if developed and used during drought periods would have the impact of increasing supply availability by 5 GL/annum. In other words, access to this 'bank' of drought insurance allows normal levels of annual usage from the dam, even outside of drought, to be increased by 5 GL/a without lowering system security. Further groundwater sources which could provide an additional 15 GL/annum during drought are currently under investigation.

The proposed Western Sydney Recycled Water Initiative is a major undertaking in the final stages of development, with an Expression of Interest to be issued in June 2006. One component of this scheme is to provide return flows to substitute for water currently taken from Warragamba Dam for agricultural and river health purposes. In addition to the impact that this proposal has in reducing the demand for water from storages, it would also have the effect of increasing supply availability by 18 GL/annum by 2015.

The planning and preparation for a desalination plant in Sydney changes the supply availability, and increases the security of supply, merely through the ability to construct such a plant during times of deep drought. As was noted earlier, the existing planning and preparation work means that the lead-time for construction has decreased to about 26 months. This means that it is not necessary to trigger the decision to build such a plant until storage levels drop below 30% of the extended storage capacity. There is only an extremely small probability of reaching this trigger level given demand projections to 2015.

While in the short term it is important to ensure that we are able to deal with the current drought situation, once dam levels move back to pre-drought levels, the risks for many years beyond that will drop dramatically.

There are a number of options to increase the available supply beyond these levels. These options include increased transfers from the Shoalhaven, for example, through changes to the operational arrangements - that is, increasing the trigger level for pumping from 60% to 80% of the system storage level. *Further increases* in Shoalhaven transfers will require major capital works to augment Tallowa Dam, and/or to increase the transfer capacity through a pipeline or tunnel. These major infrastructure works could increase the supply availability by up to 115 GL/annum, but at a very high capital cost (approximately $800 million).

In addition, marginally increasing the frequency of low level restrictions (not including the current, Level III, restrictions) is an option that would appear to have strong public support (Taverner Research, 2005; Sydney Water, 2003b) and effectively increases the amount that can be safely drawn from storages. This would represent a relatively easy means of complementing the new operating environment in which there is the capability to construct and operate a desalination plant in the

unlikely event that storages should fall to very low levels. Further investigation is required of the impact and cost of restrictions, and improved methods of efficiently achieving demand reduction during drought, including pricing mechanisms (Duke and Ehemann, 2004).

Should short-term conditions trigger the need to invest in desalination (or if a desalination plant is in any case built) then the plant could be ramped up to increase supply and to act as a source of growth water. The relevant costs in weighing whether this makes sense relative to other alternatives would be the operating costs of the desalination plant (inclusive of the costs of any carbon offsets), since the capital costs would by then be sunk costs. Once a desalination plant is built, the economics of alternative supply sources can be expected to change dramatically.

4. Demand for water

This section explores the predicted demand for water and the effect of current and future options on mitigating this demand. There are two components to understanding the actual demand for water:

a) the 'base case' demand, also called 'reference case' demand (this is the underlying demand for water, not including the impact of water efficiency options, recycling schemes and restrictions);

b) the impact of water efficiency options and recycling schemes (which substitute water from storages with an alternate source of water or with a technology that requires less water)

The *actual demand from water storages* is calculated by subtracting the savings which are achieved through demand reduction measures from the base case demand. Each of the two components is discussed in more detail in Sections 4.1 and 4.2 respectively.

4.1. Base case demand

The current approach to calculating the total system demand for water in Sydney, is to estimate the water demand per capita per day and multiply this by the current population to give the total demand.[2] The Metropolitan Water Plan 2004 used a per capita demand estimate for the base case of 426 litres per day. This estimate is considered high and does not rely on analysis of water end-uses and the impact of urban consolidation on per capita demand. Analysis of the appropriate base case demand is currently being undertaken, but the most likely estimate falls between 400 and 426 litres per capita per day by 2015.

To be conservative, the figure of 426 litres per capita per day has been used in analysis in this report. The effect of the base case demand being closer to 400 than to 426 litres per capita per day would be to reduce actual demand by up to 40 GL/annum in 2015.

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[2] This per capita demand includes residential demand, non-residential demand and system losses.

Further details about the individual demand reduction measures are provided in Section 4.2.

4.2. Demand reduction measures

There is a range of current and approved water efficiency options and recycling schemes which reduce the actual demand from the base case. These are summarised in Table 1.

Table 1: Demand reduction measures and their estimated demand reduction by 2015

Option / Scheme	Estimated Reduction by 2015 (GL/a)	Description
BASIX	23	The Building Sustainability Index (BASIX) is an assessment tool that mandates a level of water demand reduction in new and renovated homes.
Sydney Water existing Demand Management Programs	65	Sydney Water's demand management programs include active pressure and leak management, the Every Drop Counts (EDC) business program, retrofitting residential households and rebates for rainwater tanks.
New Demand Management Programs	5	Five new demand management options proposed to enhance the existing programs.
Water Savings Fund	14	This is a DEUS administered program which facilitates water saving projects put forward by businesses, councils or other government agencies, organisations or community groups.
Water Savings Action Plans	5	Water Savings Action Plans are required to be prepared by large water users to identify savings.
Appliance Standards and Labelling	13	This program involves the introduction of mandatory labelling followed by minimum standards for a range of water-using appliances under the Commonwealth Government's Water Efficiency Labelling Scheme (WELS).
Recycling schemes (current and approved)	17	Involves the use of recycled water replacing potable water use in industry (notably BlueScope steel), at sewage treatment plants and in residential houses through dual reticulation.
Stepped tariff for pricing and Outdoor water savings measures	20	Includes the introduction of step pricing as recommended by IPART. The outdoor water saving measures involve the introduction of ongoing low level outdoor water use conditions commencing at the end of the current drought restrictions and supported by ongoing community education.
Recycling schemes (proposed)	20	Additional local recycling schemes and the Western Sydney Recycled Water Initiative.

The demand reduction measures target a diverse market for achieving water savings. Retrofits and rebate programs target existing multi unit and single residential households. BASIX targets new homes built and renovations. SWC's 'Every Drop Counts' program involves working with schools and high water using businesses to achieve reductions in demand. Recycling schemes target industry and residential markets, in part driven by the requirements of BASIX.

Water savings offered by some of these programs, such as recycling, have a relatively high unit cost. However, the rationale for recycling schemes extends well beyond water supply – these schemes can offer significant benefits in reduced costs of wastewater management and/or reduced adverse impacts from nutrient discharge to the environment. Nonetheless, across this range of measures there is likely to be scope for achieving progressive improvements in cost effectiveness through fine tuning of the 'portfolio' of measures.

The total potable water savings from water efficiency and recycling schemes in 2015 and 2030 are shown graphically in Figure 1.

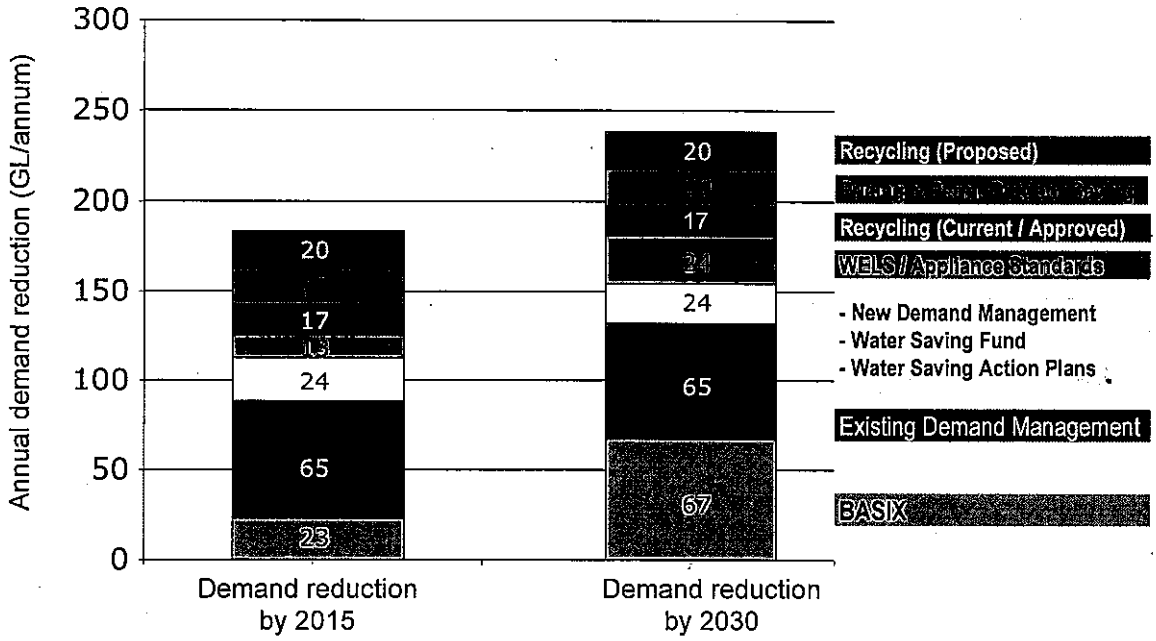

Figure 1: Demand reduction by 2015 and 2030

Figure 1 shows that the majority of savings are attributable to water efficiency options. These estimates are based on current information from the agencies responsible and have been adjusted where necessary to avoid double counting of savings.

5. Supply-demand balance

Sections 3 and 4 have discussed the status of options for supply and demand. This section now evaluates the supply-demand balance at 2015 and 2030 and discusses the implications of these results in the context of an adaptive management planning strategy.

5.1. Medium term (2006–2015)

Actual demand is calculated by subtracting the effect of demand management measures from the base demand. This is shown for the upper and lower cases in

Figure 2 and Figure 3 based respectively on an assumption of per capita demand of 426 litres per person per day and 400 litres per person per day.

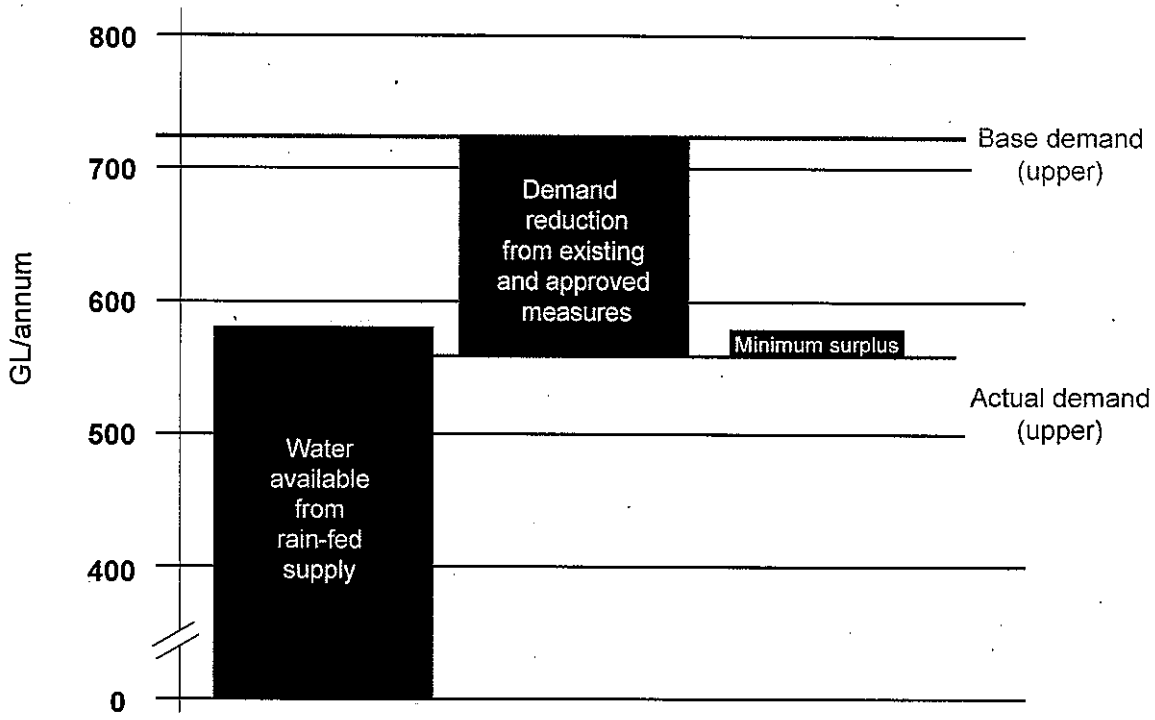

Figure 2: Supply-demand balance for 2015 (upper estimate)

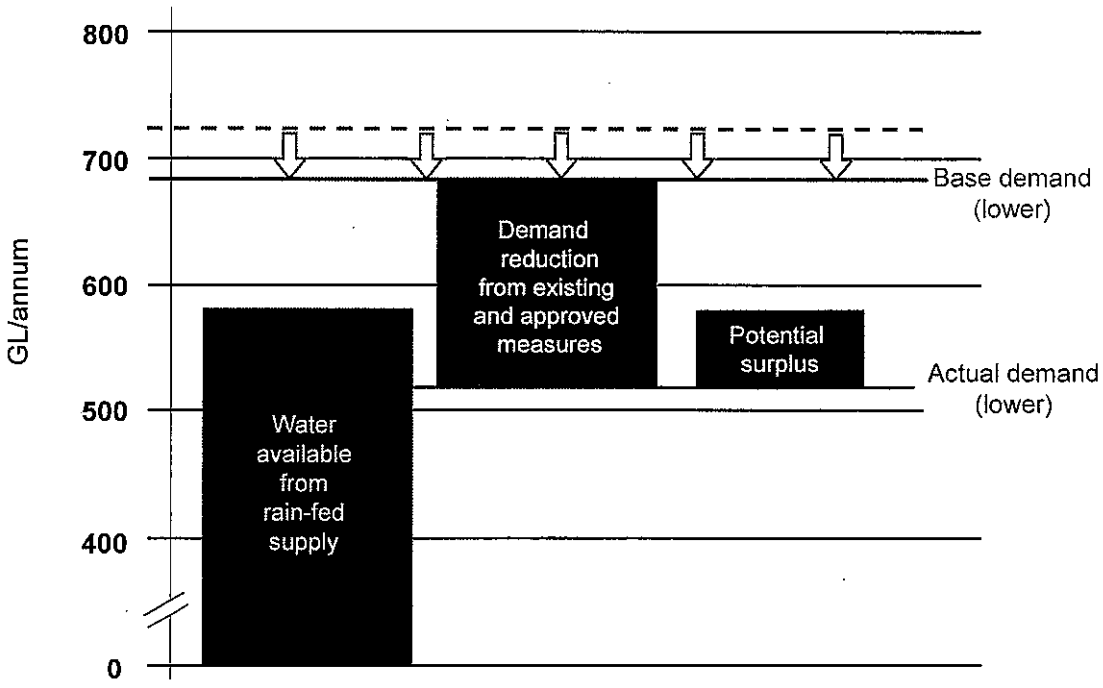

Figure 3: Supply-demand balance for 2015 (lower estimate)

Both the upper and lower demand assumptions imply a surplus, with a substantially larger 'safety margin' with the lower figure.

This indicates that the likely surplus in 2015, is likely to be between 20 GL/annum and 60 GL/annum depending on the assumed base case demand. This does not include the impact of 20 GL/annum of proposed recycling schemes or additional water efficiency options that may be implemented in future, or the increase in water supply availability (18 GL/a) that would be provided by the use of return flows from the Western Sydney Recycled Water Initiative.

5.2. Longer term (2015–2030)

In the longer term, there are two principal issues which will affect the supply-demand balance. First, the proposal to dedicate water for Warragamba environmental flows on which a decision is yet to be made. This would reduce supply availability by approximately 82 GL/annum. Secondly, by this time, population growth may start to drive demand back up as the current suite of low cost water efficiency measures and recycling schemes will have been taken up before 2015.

This could lead to a supply-demand gap on current estimates. However, there are a range of options available to close this gap, including increased transfers from the Shoalhaven.

There is also likely to be further cost effective water efficiency and recycling potential that could in future help to narrow the supply demand gap.

There is sufficient time for planning within an adaptive management framework, and ensuring that there is a level of community engagement in this decision making process that is commensurate with the significance of, and public interest in the decisions.

6. The role of desalination

Reference has been made at several points to the potential role of desalination in relation to future supply security. However, the above discussion of the supply-demand balance was predicated on existing measures, but without formally including desalination. In this section we consider in more detail how it might sensibly fit into the strategy.

Technically, the existing measures underlying the above assessment include the triggering of Level IV restrictions if dams fall below 35 per cent and Level V restrictions if dams fall below 25 per cent. These restrictions have never been invoked.

If Level 5 restrictions ever needed to be triggered, requiring a reduction in demand of 50%, the economic costs would be very high – with substantial implications for industry, employment and production as well as residential usage.

As was noted earlier, the simulation modelling suggests that the likelihood that they would be invoked over the next 10 years is extremely small - a probability of about 2.5% for Level IV restrictions and 1.15% for Level V restrictions; even these figures

are 'high' as a result of the initial dam levels used in these simulations – the long run probability of these restrictions is much lower than this, and is required to be so as part of the operating regime. However, the option of implementing Level IV and V restrictions, as an extreme response to an extreme drought, has until now been essential to supporting the safe supply estimates – and is built into the revised availability figure of 580 GL/annum.

Removal of Level IV and V restrictions, without a compensating measure, would reduce water availability by about 65 GL/annum – implying a supply gap by 2015 if demand levels are towards the upper end of the modelled range. The fact that a measure (which the Government has not needed to trigger even in the second worst drought on record) can have this impact on supply availability is further evidence of the way that measures tightly targeted at extreme drought needs can 'punch above their weight class'.

Another measure tightly targeted at extreme drought would be adopting a desalination strategy, whereby a a desalination plant would be built in time to mitigate extreme drought threats – but such commitment would be delayed as late as is safe. Based on the work done to date, the most likely strategy that would offer both total security and reasonable management of costs would be one that involves an initial commitment, once storages reach critical levels, to a 125 ML/day plant, but with inlet and outlet pipes sized to allow later upgrading to as much as 500 ML/day.

A 125 ML/day plant offers a valuable buffer, but cannot guarantee absolute security through the most extreme drought conditions. In a truly extreme drought, it would be possible that an upgrade would need to commence even before the 125 ML/day plant began operation. However, in most cases, commencing with commitment to a 125 ML/day plant could be expected to 'buy' enough extra time to allow the drought to break before there would be a need to trigger the upgrade. Having access to the upgrade would, however, allow the trigger point for even the 125 ML/day plant to be set at a much lower level than would otherwise be needed to deliver adequate security.

As with Level IV and Level V restrictions, a central feature of a cost effective desalination strategy is implementing other measures to ensure that the probability of triggering construction of the plant remains very low. Key elements here include maintaining pressure on other more cost effective measures for limiting demand and/or expanding supplies, and keeping in place the necessary arrangements to allow the desalination plant to be built with a short lead-time. This could be expected to involve some ongoing investment in retaining access to a site along with suitable approvals etc. Provided this is done, construction of the plant before it is actually required to deal with critical dam levels appears to add nothing to system security but would bring forward a large set of infrastructure costs. We estimate that the financial savings that accrue from deferring construction until required are in excess of $950m.

One way of looking at this approach to fitting desalination into the overall strategy is as insurance. Building a desalination plant could be viewed as the up-front premium. This would be costly, but the subsequent 'excess' in the event that the plant is needed would be modest. Alternatively, a modest investment can be made in the premium – in the form of maintaining the capability to roll out a plant with a short

lead-time, with a much higher excess in the event that the plant is needed. Given the very low chance of needing the plant for a long time, the low premium/high excess strategy has considerable appeal.

Another feature of delaying the need to build the desalination facility is that it may well allow a lower cost, less energy intensive plant to be built when the need arises. There has been a sustained trend towards increasingly efficient and cost effective desalination technologies for many years now, and this trend is likely to persist.

Finally, it is worth noting that the potential role for a desalination strategy in eliminating the need for Level IV and V restrictions can go further. Logically there is scope for trading the likelihood of Level I to III restrictions against the likelihood of triggering a need to build the desalination plant. The question of fine tuning the mix and frequency of restrictions with the likelihood, and therefore expected costs of desalination being needed, will be discussed in our further report. For now we note that the ability to bring in desalination could be used to revise the frequency of the Level I to III restrictions. The 'right' balance will depend on factoring in the community preferences in addition to the economic analysis.

7. Conclusions

The ability to provide supply security, means that the community of Sydney now has considerable flexibility in facing the future of water supply. There is a strong case for now exploiting this flexibility in meeting its long term water needs. This suggests that serious consideration should be given to modifying the form of the more recently announced desalination strategy, and adopting a new approach to securing supply in the 2006 Metropolitan Water Plan.

The ability to defer major capital expenditure also allows for adaptive management in the post-2015 period. In the intervening time, a range of studies will be finalised, including into the impact of climate change on our water supply system and improvements in the demand forecasts. In addition there is scope to take advantage of new information and emerging technologies which can lower costs and energy use to meet the supply-demand balance. Finally, many of the decisions to be made should rightly involve citizens in the decision making process, given their significance, and the additional time will allow this to occur in a robust and considered way.

Based on conservative assumptions, the financial benefits of not needing to proceed immediately with the desalination plant have been assessed as likely to be in excess of $950m in current dollar terms. Achieving these gains will require *maintenance of the capacity* to bring desalination into the system with a short lead-time. Given the low likelihood that this will be necessary for many years, insurance structured this way offer good value for the community.

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