AUSTRALIAN WATER CONSERVATION AND REUSE RESEARCH PROGRAM

P Dillon, D Ellis

Why Do We Need Such Research?

Conservation and Re-use

Security of Australian city mains water supplies is diminishing due to population growth, capped catchments and aquifers, increasing climate variability, lowering of dam spillways, and environmental flow requirements. Yet all capital cities discharge more stormwater and treated sewage than they import from catchments. If irrigation farms had water use efficiencies as low as cities they would be closed.

Figure 1 shows the current position, where only 4% of urban roof rainwater and stormwater is harvested and less than 1% of reclaimed water is reused within cities. It also shows a possible future scenario where the draw on catchments could be halved, through a combination of urban water conservation, use of rainwater and stormwater and urban reuse of reclaimed water. Water stresses and physiographic features differ between cities so gross savings and the means of achieving them will also vary. Urban consolidation will also change water usage patterns. Policy changes will be needed to allow water supplies to adapt.

Water conservation and reuse to achieve water secure scenarios requires research to underpin policy changes.

Investment

Major corporate water utilities are obliged to return dividends to state governments. In 2000/01 WSAA utilities servicing 14.4 million Australians generated $4.7 billion income and returned $1.15 billion to governments. Under the COAG agenda with volumetric water pricing, such pricing and policy signals are incompatible with securing water supplies for cities. A revised basis for water pricing is essential to free up change. This may take into account separation of water and land as per the rural community. Capital investment of $1.8 billion ($0.3 billion of which came from subdivider/developers) was committed to water and wastewater infrastructure in 2000/01, and a further estimated $0.9 billion in stormwater assets. With some exceptions this binds consumers to existing sources of water supplies for the next 50 to 100 years. *Research is needed to ensure viable sustainable alternatives for this level of investment.* This is needed quickly to reduce waste of water and money, through integrated water planning.

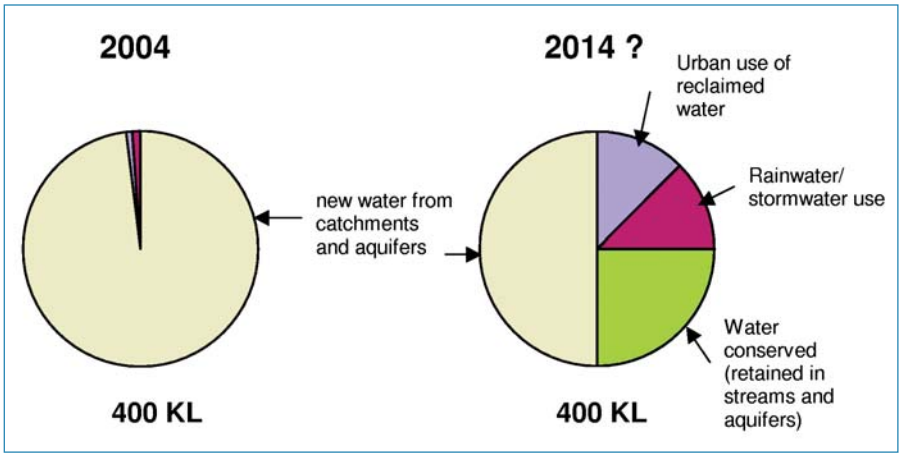

Figure 1. The proportion of Australian capital city water supplies by source (a) in 2004 expressed as annual water consumption per property and (b) for the same volume of water, a scenario for 2014 showing potential for alternative sources and water conservation. (Note that equivalent volume for residential properties only is 260KL).

Conservation measures

Per capita use of water in most cities has declined over the last two decades. The simplest and cheapest water conservation measures have already been adopted and costs of future initiatives will increase. *There is a need for research to target the best options,* and rank these against other measures, taking current externalities and technology development into account.

Wastewater discharge

The volume of sewage treated, 1540 GL (in 2000/01), is 62% of the water supplied (2480 GL) varying between cities from 38% in Perth to 82% in Sydney, depending on use in urban irrigation and evaporative air conditioning, and the extent of urban consolidation and wet weather and groundwater ingress to sewers. Saline groundwater ingress can significantly increase the cost and viability of water reuse. 36,000 Tonnes of nitrogen were discharged to the coast adjacent those cities in 2000/01, at an environmental cost which is as yet unaccounted Further treatment to reduce nutrient emissions will create wider opportunities for reuse with reduced impacts on groundwater quality. *Tradeoffs need further research.*

Stormwater harvesting

Rainfall varies between the major state capitals from 530 mm in Adelaide to 1230 mm in Sydney. However, the mean rainfall for the driest six continuous months ranges from 120mm in Perth to 490mm in Sydney. Storage requirements for utilization of rainwater and stormwater therefore differ widely between cities. Besides tanks for roof runoff, subsurface storage options are proving economic in Adelaide for stormwater and reclaimed water reuse, and these need *research to enable application to a wider range of aquifers, source waters and target water uses.* The consequences of not harvesting and using rainwater are larger storm water pipes and higher incidences of flooding. In most capital cities storm water and water supply systems are operated by different organizations with little account taken of the benefits to whole systems by linking them. Clearly a *holistic approach to water management warrants research* since it can produce solutions for water supply and storm water management than are cheaper than looking at these systems separately.

Progress

AWA Water Recycling Forum's first national conference in Adelaide in October 2000 unanimously endorsed a resolution to establish a coordinated national water reuse research program. Under the auspices of a steering committee composed of representatives of AWA, CSIRO and CRC Water Quality Treatment, the Australian Water Conservation and Reuse Research Program (AWCRRP) was founded in 2003. This is in two stages. Stage 1 reviews the research in a number of fields identified to be critical to wider adoption of water conservation and reuse in Australia. See Table 1. Stakeholders were sought and work commissioned, and this will be presented in workshops in each state capital in Autumn 2004. Further stakeholders are needed. The second stage is to identify and initiate a national portfolio of innovative demonstration projects and develop the research program to support those.

A framework to enable more sustainable use of water in Australian cities has yet to be adopted. Given that all cities face similar challenges, the synergies between knowledge gained in different cities, and the need for cost efficiency, a coordinated national research program is essential. Investment is needed from government at all levels, and water, real estate and finance industries. Linkages to international research programs in this field have already been generated to create even greater benefits.

For further information on AWCRRP see the AWCRRP web page: www.clw.csiro.au/priorities/urban/awcrrp.

To become a stakeholder, please contact: Clare Porter, cporter@awa.asn.au or David Ellis, AWCRRP Manager. 08 8303 8420, David.Ellis@csiro.au

Table 1. Australian Water Conservation and Reuse Research Program - Stage one research activities and international research links

The big picture

Inventory of water conservation and reuse activities and issues in Australia. *John Radcliffe, Project Director, Australian Academy of Technological Sciences and Engineering.*

Australian water-sensitive urban design: recent developments, new knowledge. *Tim Fletcher, CRC for Catchment Hydrology*

Integrated water management: Australian case studies. *Grace Mitchell, CSIRO*

Social acceptance

Factors affecting public perceptions of water reuse. *Murni Po, Juliane Kaercher, Blair Nancarrow, CSIRO*

Health and risk assessment

Health aspects of water conservation and reuse, and proposed new national guidelines. *Tony Priestley, CRC Water Quality and Treatment*

The fate of viruses and other pathogens: understanding health risks in non-potable reuse of stormwater and reclaimed water. *Simon Toze, CSIRO*

Quantitative risk assessment workshop, covers health guidelines on water reuse. *Ted Gardner, Qld Department of Natural Resources and Mines*

Implementing new technology

Innovative management systems for domestic scale harvesting of rainwater and stormwater, reuse of grey water, and on-site treatment of effluent. *Clare Diaper, CSIRO*

Review of National and State plumbing codes and changes required (to facilitate the above). *Ray Herbert, Gary Workman, Greg Tink, GreenPlumbers, MPMSA and RMIT University*

Agricultural and Environmental Issues

Endocrine disruptors and pharmaceuticals. *Guang-Guo Ying and Rai Kookana, CSIRO*

Impacts on crop quality from irrigation with reclaimed water. *Murray Unkovich, Daryl Stevens, Guang-Guo Ying & Jim Kelly, Adelaide Univ, CSIRO & ARRIS Pty Ltd*

Impacts on soil, groundwater and surface water from sustained irrigation with reclaimed water. *Daryl Stevens*

Water reuse for horticulture: guidance for irrigators and industry development, management methods to improve water use efficiency and sustainability. *Jim Kelly, National Water Reuse Coordinator, Horticulture Australia; Anne-Maree Boland, Vic Dept Primary Industries; Murray Chapman, Land and Water Australia*

Economics and contractual arrangements

Economics of water conservation and reuse, including externalities and life cycle costing. *Darla Hatton MacDonald, CSIRO*

Position paper on economic, institutional, policy and regulatory barriers to efficient urban water management in Australia. *Darla Hatton MacDonald, CSIRO*

Manual of contractual arrangements for reuse projects, supplier/buyer relationships. *Andrew Sherman & Astrid Di Carlo, Russell Kennedy Solicitors*

International Links

American Water Works Association Research Foundation, Water Reuse Foundation, Global Research Alliance, European Commission via Aquarec-Oz, UNESCO, WHO

Acknowledgements

The authors thank the stakeholders of AWCRRP, who at the time of paper preparation are: Australian Water Association, CSIRO (Land & Water, Manufacturing and Infrastructure Technology, and Healthy Country Flagship), Victorian Smart Water Fund, United Water International, Water Corporation WA, Queensland Department of Natural Resources and Mines, Northern Adelaide Barossa Catchment Water Management Board, Patawalonga Catchment Water Management Board, City of Albury NSW, Brighton City Council Tas, City of Mount Gambier SA, City of Mitcham SA, Western Water Vic, Beaudesert Shire Council Qld, Wide Bay Water Corporation Qld, and Ipswich Water Qld. (Stakeholders have contributed to the program to make it possible, and receive copies of draft reports, progress reports and free invitations to stage one workshops.)

Finally we acknowledge the support of members of the AWCRRP Steering Committee who have been involved in developing this program: John Anderson, Chris Davis, Peter Donlon, Geoff Syme, Carol Howe, Heather Chapman, Tony Priestley, Howard Gibson, Brian McRae and John Langford, and the encouragement of Water Recycling Forum State Representatives.

The Authors

Peter Dillon is Coordinator of AWCRRP, leads the CSIRO Water Reclamation Research Team in CSIRO Land and Water, Adelaide, and is a founding member of AWA Water Recycling Forum. peter.dillon@csiro.au 08 8303 8714. **David Ellis** is the project manager of the Environmental Projects Office Adelaide also located at CSIRO Land and Water Adelaide and Manages the Adelaide Coastal Waters Study and AWCRRP, david.ellis@csiro.au 08 8303 8420.