

Using agricultural water for urban growth in Australia - opportunities, issues

by Mark Hamstead¹

Hamstead Consulting Pty Ltd

NSW, Australia

Introduction – the increasing tension

In the world's driest inhabited continent there are many competing demands for water to support growth and development. With two thirds of the water use in Australia being for irrigated agriculture, diverting a part of this water to urban supply has to be considered as an option to meet the needs of Australia's growing population.

So far in Australia supplying water for urban growth has not had a significant impact on irrigated agricultural production. One reason for this is that the major irrigation areas are largely drawing their water from different sources to the major cities, and the cities have been able to supply their water needs from their long established sources.

However the major metropolitan centres (Sydney, Adelaide, Brisbane, Melbourne, Perth) already have or are approaching the limits of their current resources. The recent drought has forced governments to look for additional ways to both increase urban water supplies and make current supplies go further.

In many parts of the country, the best dam sites have already been utilised, and scope for expanded harvesting of surface water is limited. In addition, recognition of the need for environmental sustainability is, if anything, driving a partial reversal of water use development, through the re-allocation of water back to ecosystems. Consequently new sources of naturally occurring fresh water are few and often far away.

Increasingly questions are being asked about supplying city urban supplies from existing sources which are currently used for irrigation. Ken Matthews, CEO of the National Water Commission, in a recent speech² outlined seven issues that needed to be re-thought, the second of which was:

“Is it necessarily so that urban water supplies should not be bought from irrigators? I wonder whether that's a rational and defensible approach. I fully understand that that's very sensitive and raises all sorts of concerns in regional Australia, but I wonder whether that's the sort of position that a nation trying to allocate its scarce water resources wisely ought to be taking.”

In a recent report by Monash University and the CSIRO, it was highlighted that the ongoing exclusion of rural - urban water trading would significantly affect national economic growth over the next quarter century, because cities would be forced to adopt more costly options for water supply³.

¹ Mark Hamstead has over 20 years experience in water resource management, mostly in a senior role in the NSW government. His work over the years included development and implementation of state water policies and water legislation, as well as contributing to national water policy agreements. In July 2005 Mark left the public service and to work as an independent water policy consultant.

² National Water Commission, *Presentation by Ken Matthews to the Australian Water Summit*, Sydney, 13 March 2006

³ Young, M., Proctor, W., Ejaz Qureshi, M., Wittwer, G., *Without Water: the economics of supplying water to 5 million more Australians*, CSIRO and Monash University May 2006

The National Water Initiative calls for urban water reform to 'facilitate water trading between and within the urban and rural sectors'⁴. In its recent report on progress in implementing the Initiative, the National Water Commission noted that this type of trading is still in its 'infancy' and highlighted the need for governments to give priority to further work in this area⁵.

In fact there have been very few examples of trading of water entitlements between irrigation and urban uses. The South Australian Water Corporation has commenced purchasing some water entitlements from irrigators in the Lower Murray Swamplands, generally associated with the retirement of those lands from dairy farming. The Western Australian Water Corporation has negotiated a purchase of irrigation entitlement from Harvey Water, in return for investment in infrastructure which will result in water savings equivalent to the entitlement purchased. These examples represent trade on the 'edge' of irrigated water use, since there are other drivers for retiring the South Australian Swamplands from production anyway, and the Harvey water trade will not result in any reduction in irrigation.

Rural - urban water trading is not generally greeted with enthusiasm by the rural sector. The very suggestion has for a number of years typically drawn a sharp response from rural lobby groups. Many rural people see such proposals as a further encroachment of the cities at the expense of regional economies and regard them with considerable animosity.

Australia's major cities – running out of water

The major Australian cities are all running out of water. The recent extended dry period has tested current water supply arrangements and found them wanting. Restrictions on water use have become the norm. Additionally, scientists point to strong evidence that climate change will keep things drier. The real possibility of a major city running out of water has forced procrastinating governments into action.

The NSW government has finally taken action to shore up Sydney's water supply, which for a number of years was using more water than its reliable system yield anyway (635 GL/year use compared with a reliable supply of 600 GL/year). Amid ongoing controversy an initial metropolitan water supply plan was released in 2004, followed by a revised replacement plan in 2006. A desalination plant was announced, then indefinitely postponed. The 2006 plan contains a range of measures including emergency access to groundwater and increased recycling of waste water⁶, which are expected to extend the viability of the supply system until 2015.

The Queensland government has likewise reacted to dwindling water supplies. In July this year the Premier announced a proposal for a 'water grid' to connect the major urban areas of the south east, plus the construction of two more dams to feed into it. Additionally a study was commissioned into the feasibility of piping water 1200km from the Burdekin in north Queensland, though this was stated to be for long term planning purposes only.

The Victorian government has release a draft strategy⁷ for Melbourne's water supply, which forecasts a likely shortfall of 201GL/yr by 2055 unless action is taken. The strategy looks to a range of options to reduce demand, and increase supplies. The supply increase options include recycling, stormwater use and desalination.

4 Council of Australian Governments, *Intergovernmental Agreement on a National Water Initiative*, 2004, clause 90.

5 National Water Commission, *Progress on the National Water Initiative: A Report to the Council Of Australian Governments*, June 2006.

6 NSW Government, *2006 Metropolitan Water Plan*, April 2006

7 Government of Victoria, *Water Supply-Demand Strategy for Melbourne 2006—2055*, April 2006

In Western Australia, where climate change has already bitten hard, reducing inflows to dams by around 50%, the state government is investing in a range of measures to expand water supplies including increased access to groundwater, a desalination plant and an agreement with irrigators to purchase water saved by converting channel systems to pipes.

Only in Adelaide is buying water from irrigation part of the strategy for securing water supplies.

Urban-rural trading opportunities

Currently 67% of water use in Australia is for irrigated agriculture compared with 12% for urban supplies⁸. Overall then, a 50% increase in water for household and urban commercial activities could be achieved by a 9% reduction in agricultural water. In NSW irrigated agriculture accounts for 78% of water consumption, while Sydney's water usage accounts for 6%, so a 50% increase in Sydney's supply could be obtained from a 4% reduction in rural agricultural water.

What limits making this sort of interchange possible is the ability to connect these cities into the major rural water supply systems.

A national water grid – pipedream or possibility?

For all the wealth of the gold mining town of Kalgoorlie, there was one vital thing that they did not have – water. In 1903 the first water was pumped from Perth to Kalgoorlie, 600 kilometres east, along the newly built Coolgardie Water Supply pipeline.

This major engineering feat was treated with much scepticism by the press and politicians of the day. Now, over 100 years later, the Coolgardie Water Supply pipeline supports rural populations and mining and agricultural developments over a wide area of Western Australia.⁹

In South Australia Adelaide is supplied by a 60 km pipeline from Mannum and a 48 km pipeline from Murray Bridge, including a set of pumps that raise up to 163 GL per annum 418 metres over the Adelaide Hills. There are also two 379 km pipelines supplying water to Whyalla, Port Pirie and Port Augusta.

Water weighs a tonne a cubic metre, or 1000 tonnes a megalitre, so pushing water around the country is not a cheap exercise, far more expensive than natural gas. Nevertheless piping water large distances is already a reality in Australia. In all these cases it has been well worth doing.

While these distances are substantial, the costs place limits on what is viable. In addition to the cost of installing and maintaining the pipes, there is a substantial energy cost in pumping the water to overcome both height differences and friction losses. In the recent study commissioned by the Western Australian Government into the feasibility of piping water from the Kimberleys to Perth, it was found to be far more expensive than the alternative of running a desalination plant in Perth. Estimated cost of a 1900km 100GL/yr pipeline amounted to \$5.10 per kL, compared to \$1.16 per kL for the desalination plant¹⁰. Clearly a 'national' grid for water is a long way from being viable, but there are a number of possibilities for connections at the regional level.

Opportunities for sourcing urban supplies from irrigation water

If desalination is taken as the benchmark alternative, and the costs per km found for the Kimberleys to Perth study are taken as an indicator of piping cost, then you can pipe water up to approximately 430km before you exceed the cost of desalination. This of course is only a rough

⁸ ABS (Australian Bureau of Statistics), *Water Account Australia 2000-01*, 2004

⁹ Maynard, C., *More Precious than Gold*, at <http://kernow.curtin.edu.au/www/G&AWS/G&AWS.html>

¹⁰ WA Department of the Premier and Cabinet, *Options for bringing water to Perth from the Kimberley: An Independent Review*, 2006

indicator because costs for both piping and desalination vary in different circumstances, but it does give a rough idea of the viability of piping water large distances.

So looking at our major cities, and taking 400km as an indicator of maximum viable distance for piped connection, there are in fact several possibilities for connecting them into the large rural irrigation supply river systems. While the feasibility of each of these possibilities will vary depending on local terrain, the fact remains that they are on the face of it worth a serious look.

Adelaide is already connected to the River Murray, where total irrigation entitlements exceed 4000 GL/yr. Melbourne is well within range of the Goulburn system, with total irrigation entitlements of approximately 1900 GL/yr (under 100km) and could also be connected to the Murray (approx 200km) or the Macalister with 150GL/yr (approx 200km).

Sydney could be connected to the Hunter River (150km) with irrigation entitlements of approximately 150GL/yr. Additionally this could be achieved through connecting the urban water supply systems of Hunter Water Corporation, the Central Coast (Gosford Wyong Water Authority) and Sydney Water into one linked system. Alternatively there is the possibility of a 250 km pipeline to connect Burrunjuck on the Murrumbidgee (irrigation entitlements of over 2000 GL/yr) into Lake Burragarong, Sydney's major water supply dam.

Neither Brisbane nor Perth have options into such large irrigation supply systems. Perth already have a connection into Harvey Water, with a total entitlement of 150GL/yr for irrigation, but there are no other obvious options. Brisbane's closest river irrigation system of substantial size is Bundaberg with irrigation entitlements of 183 GL/yr. However at a distance approaching 300km the limited potential for buying water is less likely to warrant such a long pipeline.

A legal anomaly

NSW legislation¹¹, extraordinarily in current times, provides that towns can have their water entitlements increased as the grow. When read in the context of water extraction limits in gazetted water management plans, this means that any such increased water rights granted must result in reduced allocations to other water entitlement holders. In other words towns, who more than nearly any other water user could afford to purchase water entitlements, don't need to buy water entitlements because it will be taken from others and given to them free of charge.

Such a situation is clearly contrary to the intent of the National Water Initiative and the idea of secure water entitlements, and destroys the potential for rural-urban trading to operate.

Potential impacts and benefits

Recent studies have demonstrated that providing for urban-rural water trade delivers substantial benefits to the economy.

Dwyer et al.¹² considered a scenario where water availability was reduced by 10% (773GL/yr) in south east Australia, and assessed how several trading scenarios could mitigate the effects on the economy. The paper showed that allowing full trade between the cities and rural areas reduced the impact by \$108m/yr (17%) compared to just allowing trade in the rural areas.

Mike Young et al.¹³ showed that, given projected increases in population and reductions in available water, connecting the cities into rural irrigation water supply systems and allowing

¹¹ NSW *Water Management Act 2000*, section 66.

¹² Dwyer, G, Loke, P, Appels, D, Stone, S and Peterson, D 2005, *Integrating rural and urban water markets in south east Australia: preliminary analysis*, paper presented at OECD Workshop on Agriculture and Water: Sustainability, Markets and Policies, Adelaide, 14–18 November.

¹³ Young, M., Proctor, W., Ejaz Qureshi, M., Wittwer, G., *Without Water: the economics of supplying water to 5 million more Australians*, CSIRO and Monash University May 2006

those cities to purchase water would greatly reduce the projected 'shadow price' of water (the price that equates supply with demand).

One of the major rural concerns is the effect of large cities entering small irrigation markets. The Dwyer et al. study noted that the entry of Melbourne into the Macalister water market could have a significant effect (for example, on the dairy industry). The reason for this is that the volumes of irrigation entitlement are so low that purchases of similar sizes to say, those recently undertaken by Adelaide (approx 24GL/yr) amount to around 20% of the irrigation entitlement.

The study continues to observe that, in practice, this will be limited by the hydrological connectivity, and that if Melbourne is also connected into the Goulburn Murray, it will likely purchase water from irrigators there, dissipating the effects in the Macalister.

Rural lobby groups often express the concern that the buying power of the cities, if they entered rural water markets, could force up the price of water. For cities the upper value they would be prepared to pay is the cost of alternatives eg desalination, less the cost of transporting the water. For many situations this will be much higher than current rural water market values.

Whether this market price impact actually occurs depends on the size of the city's desired purchase compared to the size of the market. In large markets such as the southern Murray Darling river systems, the cities are less likely to be price setters, than if they enter small markets such as the Macalister or the Hunter.

What alternatives for additional urban water supply?

For the major cities, only Brisbane is proposing new dams for additional water supply. For the other cities recycling and desalination are the two major options. Stormwater is also considered but is generally less attractive than recycling.

Desalination is a clear option for all Australia's metropolitan centres. The cost of desalination, at around \$1.20 a KL, provides a benchmark for alternatives.

Typically 50-75% of urban water supplied is discharged from sewerage treatment systems. There is considerable discussion nationally at the moment about substitutional reuse of this water for urban supply. Full substitutional reuse directly back into the water supply system could potentially meet urban water needs for many years into the future.

Currently nearly all water reuse schemes in Australia apply the treated effluent to irrigation or industrial use, rather than domestic. Partial domestic re-use is occurring in some areas such as Rouse Hill in Sydney where treated effluent is supplied to domestic dwellings through a separate pipe system essentially for outdoor use only.

The health risks of direct substitutional reuse are the main issue. The community has to be satisfied that the risks are negligible before this kind of reuse will be accepted. This inevitably pushes the costs of this option up to high levels – generally much more than the alternative of purchasing rural water where this is possible.

An option which benefits both irrigation and cities is where the cities effectively 'swap' treated effluent water for river entitlements. Something like this is occurring in the Werribee Irrigation District in Victoria, where irrigation entitlement holders are agreeing to surrender their river entitlements in return for access to a highly reliable supply of treated effluent.¹⁴ Interestingly though, the surrendered entitlements are to be put to environmental flows rather than bolstering the city's water supply, though it could have gone that way.

¹⁴ Melbourne Water and Southern Rural Water, *Werribee Irrigation District Recycled Water Scheme: Regional Environment Improvement Plan*, 2004.

In Sydney something very like this happens in an implicit way. Some 60GL/yr of treated effluent is discharged into rivers. This water, in turn, is the major source of water for a large number of small scale irrigators who take water from those rivers.

Multiple use of water, as shown in these two examples, is clearly a way to vastly increase the benefit gained from the water supplies we have. Reuse of effluent for agriculture is financially much more viable than full blown substitutional reuse because the treatment costs are not as high. Unfortunately even this is still a very limited activity for the major cities. For example most of Sydney's effluent (approx 400GL/yr) is discharged to the ocean with only limited treatment.

There is one further option for meeting future urban water needs, which would require much better integration of water supply planning into national urban growth planning, and indeed a vision for urban growth in Australia which is national in its perspective rather than state or regional. That option is for governments to consciously and effectively plan for future urban expansion to occur where there is water available to support it.

This would mean that, rather than considering piping water south from the Burdekin or the Kimberleys, governments actively put in place investment, incentives and statutory instruments which result in future urban growth being focused in the Burdekin and the Kimberleys.

Even in the south east, it is clear that the water currently used for irrigation in the southern Murray Darling could support an inland city the size of Brisbane and still have plenty of water to spare. Furthermore if such a city were established on the basis that all its treated effluent were supplied to agriculture in replacement for irrigation entitlements bought out, both the city and the irrigation industry could thrive.

Conclusion

With existing water supplies to cities under pressure due to climate change, and significant population growth anticipated over the next 20 years, water supply for cities has become the major water issue in Australia.

With such changes, there comes a time for a change in thinking. In reality the cities and the rural areas are one linked economic system and to treat them as separate entities is to waste opportunities for no reason of any substance.

While a 'national water grid' is far from feasible, there are several opportunities for the major cities – in particular Sydney, Melbourne and Adelaide – to link their water supplies into the major rural water supply systems to develop integrated and connected water trading markets which benefit all.

Lastly an option which does not seem to have been considered is, quite simply, to develop a national vision and plan for urban growth which encourages that growth where a water supply is available, and incorporates opportunities for multiple use of water to provide for both rural and urban development. Obvious locations are in the north and in the southern Murray Darling basin.