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Urban water supply in Australia: the option of diverting water from irrigation

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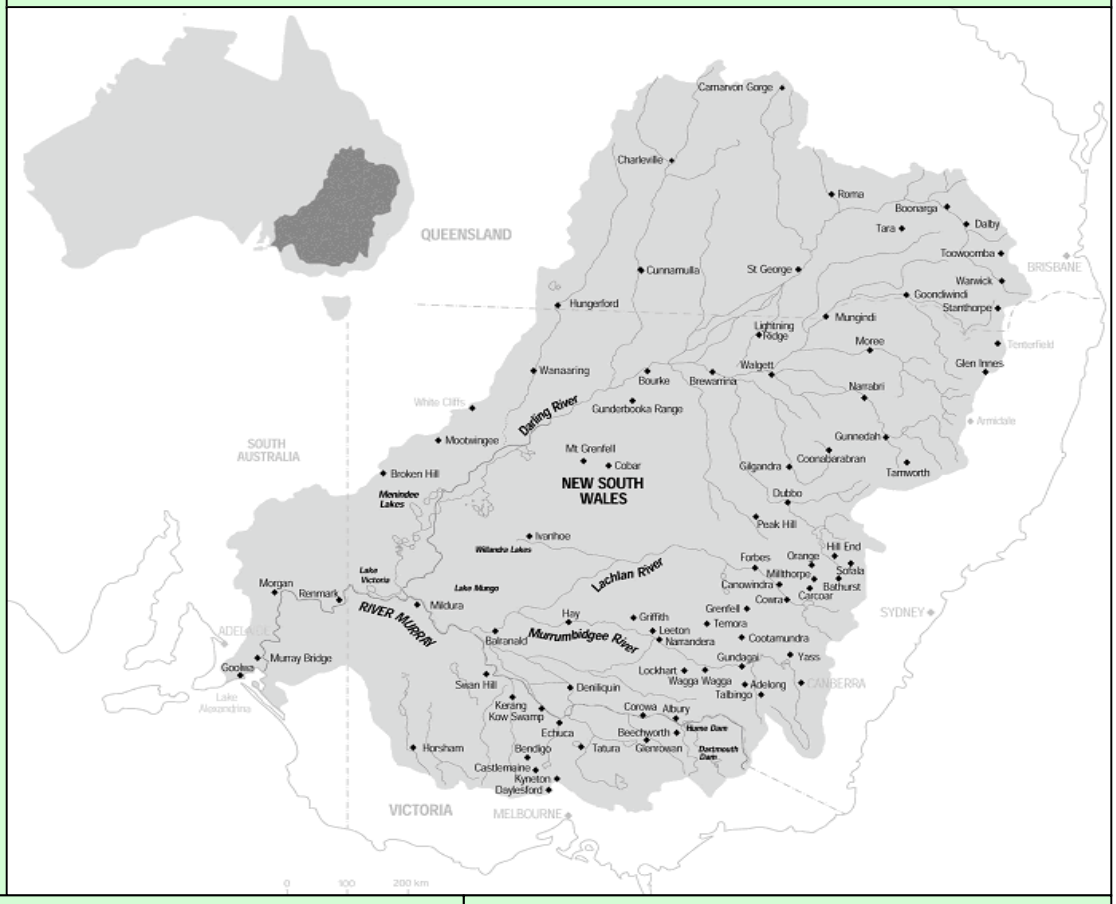

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Abstract

Most urban areas in Australia are facing the prospect of increasing scarcity of water. Further pressure arises from evidence that existing levels of water use in many catchments are environmentally unsustainable. One option, feasible for some but not all Australian cities is the diversion to urban areas of water currently used for irrigated agriculture. Such diversions are currently constrained by a range of government policies. However, plans for the creation of a national water market raise the possibility that water rights may be purchased from irrigators and used to increase the supply of water for residential use. A number of policy concerns, notably relating to stranded assets and environmental externalities must be addressed in the consideration of such purchases.

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Introduction

As every schoolchild knows, Australia is the world's driest continent, in terms of average precipitation per hectare. Less widely-known is the late Bruce Davidson's observation that Australia is the world's wettest continent, in terms of rainfall per person (Davidson 1969). Australia's central problem in water supply, therefore, is not the inadequacy of the total volume of rainfall. Rather, the problem is that water may not be available where it is demanded. Transport of water from one place to other is subject to both technological difficulties associated with the requirement for dams, pipelines and so on, and sociopolitical difficulties associated with conflicting claims to water.

Australian cities are currently facing severe, and in most cases chronic, shortages of water. Water restrictions have been imposed in all the mainland capitals, and are permanent, or likely to become so, in most cases. At the same time, large quantities of water are used in irrigated agriculture, typically with a net return well below the marginal cost of supplying additional water to residential users in major cities.

The problem is complicated by the fact that aggregate allocations of water in many catchments, and in the Murray–Darling Basin, exceed the level that is environmentally sustainable in the long term. A further problem is that climate change associated with global warming is likely to reduce runoff in much of South-Eastern Australia, though this effect is not expected to be uniform (Jones et al 2001).

In these circumstances, it is necessary to consider the option of diversion to urban areas of water currently used for irrigated agriculture. Such diversions are currently constrained by a range of government policies. However, plans for the creation of a national water market raise the possibility that water rights may

be purchased from irrigators and used to increase the supply of water for residential use.

Background

It is useful to begin with a brief survey of the water supply problem for each of the major Australian cities, and for the basins from which additional water could potentially be drawn. Alternative options currently under consideration, including desalination, conservation and recycling, will be described briefly.

Adelaide

South Australia is the driest state in Australia and Adelaide has long relied on the Murray River as a water supply to supplement the limited local sources. In an average year, the Murray River supplies about 40 per cent of the State's urban water needs. In dry years, this can increase to as much as 90 per cent.

The main local sources are the Onkaparinga and Torrens Rivers. Water is stored in a number of small reservoirs, the largest being Mount Bold with a capacity of 46 gigalitres (GL). Water is diverted from the Murray River through the Mannum–Adelaide pipeline, built in 1955 and the Murray Bridge–Onkaparinga Pipeline built in 1973 (designed to supply 163 GL per year).

Total urban water consumption is about 250 GL per year of which about 150 GL per year is residential consumption, overwhelmingly in Adelaide. Urban water consumption is about 10 per cent of total consumption in South Australia.

Adelaide is subject to permanent restrictions on water use, most notably a prohibition on the use of sprinklers during daylight hours. Additional restrictions are imposed during periods of water shortage. The public response to water shortage includes a program 'Water proofing Adelaide', aimed at reducing water consumption by 37 GL per year. and saving an additional 33 GL per year through recycling and reuse of stormwater (Government of South Australia 2005). Key elements include the permanent restrictions noted above, further measures such

as requirements for dual flush toilets and large-scale stormwater projects (each about 10 GL per year).

Brisbane and South-East Queensland

South-East Queensland draws most of its water from four large dams on coastal rivers (Wivenhoe 1165 GL, Somerset 380 GL, North Pine 215 GL, Hinze Dam 161 GL). No water is drawn from the Murray–Darling Basin and there is, in fact, a small transfer into the Basin from the Brisbane River to the Condamine River near Toowoomba (Murray Darling Basin Commission 2005). Some water from Wivenhoe Dam is used for irrigation in the Brisbane River catchment, but this use is secondary to urban use.

South-East Queensland is currently (February 2006) experiencing a lengthy drought, said to be the worst in 100 years. In response, a range of restrictions has been imposed, and a contingency plan has been developed, encompassing a range of options including use of recycled water, re-commissioning old resources/dams, desalination and exploitation of underground aquifers (SEQWater 2005, Water Forever 2005).

Canberra

The Australian Capital Territory supplier ACTEW has undertaken a reviews of water efficiency and of options for obtaining additional water (ACTEW 2005). The water efficiency measures under consideration are similar to those examined elsewhere, including restrictions on water use, multiple-block tariffs (under which the unit price varies, usually increasing, with the volume used by a household) and promotion of water-efficient appliances.

Two of the options for obtaining additional water involved the construction of additional dams on tributaries of the Murrumbidgee. The third involved purchasing water from the Tantangara Dam which stores water from the Upper Murrumbidgee for transfer to the Tumut River, ultimately returning to the Murrumbidgee near Gundagai, downstream of Canberra.

Melbourne

Melbourne draws most of its water from the Thomson River in Gippsland and from reservoirs in the Yarra Ranges east of the city. Under current policy, construction of additional dams is regarded as a last resort.

Under policy decisions dating back to the Bolte government in the 1960s, no water is transferred between the Murray Basin and its tributary catchments and the coastal area of the state, most importantly Melbourne. However, transfers from irrigation users in the Thomson river catchment and Melbourne would be feasible using existing infrastructure. More significantly, it would be possible, with relatively modest additional investment, to transfer water from the Goulburn catchment, in the Murray–Darling Basin.

Such proposals have been firmly rejected. Melbourne Water (2005) stated:

> If a new dam were built for Melbourne, it would need to be filled with water that is currently used by rural and regional communities and the environment.
>
> A new dam for Melbourne would take water from Gippsland or Goulburn Valley farmers who depend on irrigation for their livelihoods.
>
> A new dam for Melbourne would also take water from rivers that are already stressed. This would not only harm the habitat of our native plants, fish and animals, but also threaten our waterways, tourism and recreation industry.

Melbourne experienced severe drought from 2001 to 2004 and residential water users are now subject to permanent restrictions on various forms of water use.

In 2003 and 2004, the Victorian government prepared a Green paper and a White paper formulating a strategy for managing water demand and supply in Melbourne. Key elements included a three-part rising-block tariff and a variety of incentives and penalties intended to encourage particular forms of efficiency

improvement and discourage particular forms of water use regarded as wasteful. Edwards (2005) criticised these policies as inefficient, inequitable (since large households are effectively penalised by the tariff structure) and overly intrusive with respect to individual decisions on water use.

A notable feature of the policy statement is the absence of any discussion of the possibility of trade between irrigation areas and the Melbourne supply system. This amounts to an endorsement of the *status quo* under which such trade is prohibited. However, in a new environment where trade in water rights is expanding, the absence of any discussion leaves the issue of limits to trade unresolved.

Perth

Perth's water supply problems are possibly the most acute among Australian cities. In addition to a generally unfavorable location, Perth has experienced declining rainfall. As a result, the Western Australian government has been more willing than others to examine solutions that are relatively radical in technological or political terms.

A desalination plant is currently under construction at Kwinana. The proposed output is 45 gigalitres per year. The likely cost of delivered water is around $1.50 per kilolitre.

In addition, the government has undertaken some repurchase of water from irrigators in the region surrounding Perth. Water is being used to recharge underground storage areas.

During the 2005 state election campaign, Liberal Opposition leader Colin Barnett announced a commitment to build a canal to transport water to Perth from the Kimberleys, over 3700 km away. Preliminary analysis (Quiggin 2005) suggested that the cost of this option could be as high as $6 a kilolitre, and that proposals to divert some of the water for irrigation (presumably at much lower prices) could raise the cost for urban water as high as $10 a kilolitre, comparable to the cost of such fanciful options as towing icebergs from the Antarctic. The canal proposal, along with others is currently under review by a committee

appointed by the State government.

Sydney

Sydney has experienced severe droughts since 2002, and has been subject to water restrictions. Along with measures to promote efficiency in water use, several options for augmenting water supplies have been considered.

One prominent and controversial involves large-scale desalination. The proposals are less advanced than in Western Australia, but it seems likely that the costs will be broadly similar. The other main option for additional water supply involves transferring water from the Shoalhaven River south of Sydney. No new dams are currently under consideration.

In February 2006, it was announced the the proposed desalination plant would be replaced by a pilot plant. Instead, the government would rely on underground aquifers, which were said to have been shown to have potential yields higher than was previously expected.

Transfer of water from the Murray–Darling Basin to Sydney is technically feasible. A recent proposal, building on the Tantangara option for Canberra called for water to be pumped from the Murrumbidgee River into the Googong Dam near Canberra and then to the Wollondilly River at Goulburn, and on to Warragamba Dam (Wahlquist 2005).

Arguments for and against trade

The debate over the possibility of water being traded between urban and rural water users brings together participants with radically different starting points.

Economists, in general, start with a strong presumption that reducing restrictions on trade will be beneficial both for the parties directly involved and for society as a whole. While economists concede that not everyone will necessarily benefit from freer trade, they argue that gains will outweigh losses on average and that, if necessary, losers can be compensated. The influence of economists on water policy has grown over time, and has been enhanced by the

historical accident that the COAG water reform process has been closely tied to National Competition Policy.

By contrast, political actors generally take the *status quo* as their starting point, and are unwilling to promote change in the absence of a strong and widespread political demand. In the case of water supply for irrigation, the starting point is one of no trade. In addition, since the process has always been politicised, there are strong and well-established lobby groups. Some of these groups are willing to support trade between irrigators, but few support the idea of reducing the total water available for irrigation, even if individual irrigators might be willing sellers.

Ecologists and environmentalists have generally been sceptical about market-based instruments for managing resource use, seeing them as 'licenses to pollute'. There has been some change in this position over time, however, and many environmental groups support the creation of a market for carbon emission rights, proposed as part of the Kyoto protocol on climate change. In the context of the water debate, ecologists and environmentalists have usually sought to restrict and reduce all extractive uses of water, rather than to focus on irrigation, by far the largest use.

It is, therefore worth considering some of the arguments for and against allowing or encouraging trade in water between urban and irrigation uses.

Arguments for trade

The central argument for trade between irrigation and residential water use is one of economic efficiency. This argument is most commonly put in terms of efficiency in consumption. Under current institutions, residential water users typically pay marginal costs of between $0.75 and $1.50 per kilolitre, that is, between $750 and $1500 per megalitre. The price of irrigation water observed in the market for temporary transfers is commonly around $100 per megalitre (note that this figure and all those expressed here are in terms of annual costs for supply of water in a given year), though this figure varies widely.

Hence, it seems reasonable to suppose that if irrigation water users could

sell water to urban users for, say, $200 per Ml, and the costs of treating and delivering this water were say, $400 per Ml, residential consumers would want to buy additional water. As in the usual economic arguments concerning gains from trade both parties would be better off.

A more powerful version of the same argument may be presented in terms of production efficiency, with a focus on technological possibilities for water consumption. Consider the situation of an irrigation user who can implement measures to reduce losses of water through leakage or waste, at a cost of $150 per Ml saved.

Arguments against trade

Arguments against trade between irrigation and residential water use can be grouped into two main categories. These are general arguments against allowing trade between catchments, and specific arguments against allowing urban water suppliers and users to trade with irrigation users.

Arguments against allowing trade between catchments commonly involve some form of 'asset stranding'. The central idea is that the group of irrigation users in a given catchment has an obligation to maintain the irrigation infrastructure in that region and perhaps to deliver a return to owners of capital (in many cases, a co-operative owned by some group of users). If some users sell their water entitlements to users in another catchment, the costs of the infrastructure will be spread over the remaining users. Either unit charges will rise or the owners of capital will incur a loss.

The point that transfers of water entitlements out of a catchment reduces the value of irrigation-specific infrastructure in that catchment holds true fairly generally. However, the distribution of these costs (and the benefits accruing to the enhanced value of infrastructure in the receiving region) depends on details of pricing and institutions, some of which are quite subtle.

The idea of stranded assets may be extended further, to encompass social infrastructure such as schools, hospitals and banking services. If transfer of irrigation water entitlements out of a region results in a shift to less intensive

dryland agriculture, and a corresponding decline in the farming population, demand for the services of social infrastructure will decline, and this may lead to second-round effects, with schools and other services closing.

The issue of asset stranding is complex, but it is important to recognise that it is mainly a matter of adjustment costs. Hence, the appropriate response is to mitigate those costs rather than to prohibit trade altogether.

Critics of trade between urban and irrigation users raise are concerned, on the one hand, with the loss of productive capacity in agriculture and, on the other with the perceived wastefulness of some forms of urban water use. A useful way to think about this issue is to mentally substitute 'land' for 'water'. Cities have always grown by converting farmland to residential use. Concern about the resulting loss of productive capacity was a hot topic in the United States a decade or so ago, but the issue has never gained much traction in Australia.

There are good urban planning reasons for keeping green space, including farms, but few would support a total ban on the conversion of agricultural land to residential use, or a policy that required cities to accommodate all future population growth within their existing boundaries.

Similar arguments apply to water. There are reasons to be careful before moving to unrestricted trade in water rights. Poorly thought out moves in this direction have produced unforeseen consequences such as the activation of unused, but now valuable water rights (called 'sleepers') thereby exacerbating the problem that trade was meant to resolve. Nevertheless, in the long run, water should be allocated to its most highly valued use, and the standard way of doing this is through market transactions.

Potential volume of trade

Estimates of the potential volume of trade may be made either at an aggregate level, or by considering the cases of the major cities separately. A back-of-the-envelope estimate may be obtained as follows. Urban use accounts for about 25 per cent of total water use in Australia. Assuming that 20 per cent of total urban water demand was met by transfers from irrigation, the amount

transferred would be about 5 per cent of total water use, or a little over 6 per cent of existing use in irrigation. The maximum volume involved would be around 750 GL each year.

In practice, the likely maximum volume seems smaller. The options for transferring water to Sydney and South-East Queensland are limited, as are options for Perth that have not already been exploited. Growth in demand for water in Adelaide is likely to be limited in view of the city's relatively slow population growth. Thus, the most important potential transfers are those from the Murray catchment to Melbourne. As has been noted, public policy in Victoria has long been opposed to trade between the Murray catchment and Melbourne, and this opposition has not diminished thus far.

Under current conditions, then, trade in water between irrigation and urban use is likely to remain relatively limited. Nevertheless, even modest trade could significantly reduce the severity of urban water supply problems. On the other side of the market, although the impact on the aggregate supply of water for irrigation would be modest, irrigation water use in some catchments might be reduced significantly.

Moreover, it should not be assumed that current conditions will persist indefinitely. Climate change might exacerbate the drought problems now being experienced in most urban centres. Moreover, the feasibility of desalination, the main backstop technology, depends critically on energy prices. A sustained increase in the cost of electricity could greatly increase the cost of desalination.

Environmental flows

The problem of allocating water between extractive uses such as residential supply and irrigated agriculture is complicated by the fact that, in major Australian catchments, including the Murray–Darling and Snowy systems, current levels of use are environmentally unsustainable.

As a result of the Snowy River scheme, flows in the Snowy were reduced to around 1 per cent of the natural level. However, under an agreement between the Victorian, New South Wales and Commonwealth government in 2000, 28 per

cent of this flow is to be restored over 15 years, with a corresponding reduction in the volume transferred to the Murray and Murrumbidgee Rivers.

The Murray–Darling system is similarly overallocated. A scientific study hghas recommended an increase in environmental flows of 1500 GL per year or about 15 per cent of the natural flows (Living Murray Initiative 2003). Since this was the upper bound of the range of options under consideration, it seems likely that a genuinely sustainable allocation would be even larger; perhaps as much as 30 per cent of the natural flow. Under the National Water Initiative, governments have currently agreed to restore natural flows of 500 GL.

The impact of environmental flows on the possibilities for trade between urban and irrigation uses is ambiguous. On the one hand, the greater the amount allocated to the environment, the less is available for any extractive use, and hence the sharper the competition between urban and irrigation use.

On the other hand, the main obstacle to trade is resistance to the whole idea of purchasing irrigation rights and allocating them to non-irrigation uses. It seems unlikely that the reductions in irrigation use required to achieve environmentally sustainable flows can be achieved entirely through improvements in technical efficiency and reductions in seepage and evaporation (the approaches currently favoured). Sooner or later, it will be necessary to purchase irrigation allocations and convert them to environmental flows. Once this barrier has been broken the obstacles to broader trade will be substantially reduced.

Concluding comments

Severe droughts affecting most Australian cities have brought the issue of urban water supply to the top of the policy agenda. At the same time, it is increasingly recognised that existing allocations of water for use in irrigation are environmentally unsustainable. Thus far, the two issues have been handled separately and with radically different approaches. While market exchange has been promoted in the irrigation sector, urban water use has been subject to increasingly stringent and specific controls.

An inconsistent policy of this kind can lead to substantial losses in efficiency and exacerbate the difficulty of reaching environmentally sustainable outcomes. It is necessary to give serious consideration to the option of allowing expanded trade between urban water users and irrigators.

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