From: Alistair Watson [aswatson@bigpond.net.au]
Sent: Friday, 6 January 2006 11:17 AM
To: waterstudy@pc.gov.au
Subject: Submission

Attachments: AER; ACCC Paper

Dear Waterstudy,

The main parts of this submission to the Commissioned Research Study by the Productivity Commission 'Rural Water Use and the Environment: The Role of Market Mechanisms' are the two attached papers. The two papers are related. The first was written in 2003 and published in the June 2003 issue of the Australian Economic Review. The second paper was written for a conference organised by the Australian Competition and Consumer Commission in July 2005.

The purpose of this message is to make a few additional observations prompted by reading the Issues Paper for the PC Study and re-reading my own work. Information required for the Submission Cover Sheet is provided at the end of the message.

The PC would perform a valuable service if it shifted the current emphasis of the National Water Initiative away from 'water planning' which implies and almost invites bureaucratic control, and inevitably would protect established interests, towards considering markets and market mechanisms as devices for the discovery of economic information, especially about environmental facts and values. Without an economic approach, mindless and unproductive intervention is as likely in pursuit of environmental objectives as it was in the expansion phase of irrigation. A discovery view of market mechanisms rather than a planning view suggests that experiments (trials, pilots, etc) are to be encouraged. Modern theories of the economics of information should come into play in institutional design.

Reading between the lines in the Issues Paper, the official pre-occupation with water use efficiency is seen for what it is, another expression of voodoo economics and political convenience. A danger to the public of all this shoddy thinking is that the costs of investment in off-farm and on-farm irrigation infrastructure will be shifted on to taxpayers. Farmers and sections of the environmental movement could find common cause in these endeavours. There is the further prospect of engineers' picnics in the quest for water savings in the name of the 'environment' just as there was in the era of uncritical irrigationism. Romanticism and professional opportunism rather than empiricism are just as possible in modern times. Governments are still as feckless.

After a decade or more of water trading, the score is on the board with respect to its advantages. The PC needs to consider outstanding restrictions on interstate trade, interregional trade and environmental trade. Permanent and temporary trade are close substitutes so it is likely that effects on production of remaining constraints to trade are less than usually thought. Allowing environmental trade would serve several useful purposes including reducing ambit claims for environmental flows.

The PC may be dodging serious issues in the northern Murray-Darling Basin by concentrating on the southern-connected M-D system where more progress has already been made in water trading and various environmental initiatives.

The above brief remarks are meant to introduce the more detailed treatment in the attached papers.

Alistair Watson
January 6, 2006.

Submission Cover Sheet

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Competition and Water: A Curmudgeon's View

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(Paper prepared for the conference 'Relationship Between Essential Facilities and Downstream Markets' organised by the Australian Competition and Consumer Commission – Gold Coast, Queensland, Australia, 28th July 2005.)

Introduction

Water infrastructure, whether for urban water or irrigation, has natural monopoly characteristics. But water policy in Australia is burdened with something far less manageable than the complications of natural monopoly. Sadly, water policy suffers from widespread romantic, irrational views that have brought forth inadequate policy responses. This used to be more obvious for irrigation. Arguably, urban water policy is in the process of catching up. From the pervasive pro-irrigation bias of the past to today's emphasis on environmental damage caused by irrigation, a common thread in water policy has been to attribute more importance to water than is justified on wider examination of economic and other issues.

A sceptical and discursive paper on water is hard to organise. There are many variations in institutional arrangements between the states and in different parts of the water industry. No doubt counter-examples could be found to support more conformist views.

The paper consists of several loosely linked parts. The next section discusses the contest between romanticism and empiricism. The theme is expanded with a section describing the debate over 'water use efficiency'. Then follows discussion of special interests in the water industry, emphasising the influence of concerns with environmental effects of water use. Confusion has arisen with a poorly articulated philosophy of the environmental movement and ambiguous responses by governments leading to conflict over cost sharing and property rights. Natural monopoly and infrastructure issues are outlined in the following section, with comments on water pricing. Differences between pricing policy and practice for water for irrigation and urban water are noted. The following section discusses the emergence of water trading in the last fifteen years: its advantages, constraints on water trading and their effects, and water trading and the environment. The penultimate section of the paper discusses access issues in the context of the application by Lakes R Us to participate in the management of the airspace of dams in the Snowy Scheme. A brief conclusion follows.

Romanticism or empiricism in the water industry?

When it comes to water, what should be empirical questions were, and are, often treated as articles of faith. This failing is more widely recognised about water used for irrigation, following numerous powerful critiques of the chequered history of the development of irrigation. Perhaps the best known of these are two books by Bruce Davidson (1965, 1969) that still should be part of everyone's education. On a charitable interpretation, earlier romanticism about water and exaggerated hopes for irrigation in the evolution of European farming in Australia were products of ignorance and misunderstanding of the underlying facts of local economic geography, production costs and market opportunities.

The surprise of early encounters with drought was a major stimulus to the interest in irrigation. Changing water availability through water storage and river regulation is a natural reaction to water shortages in arid regions. This response missed the point that land was abundant in Australia but labour and capital were also scarce. Higher yields per unit of land are obviously achieved with irrigation but the pursuit of economic efficiency should consider all resources. It turned out that concentrating available water on small areas of agricultural land was not propitious, economically or environmentally. Rainfall variability in Australia meant that a large capital investment was required in water storages and other irrigation infrastructure compared with other countries where irrigation is practised.

Critics of Australian irrigation development like Davidson accepted that irrigation had a role in Australia. But even a limited role would have been compromised by the simultaneous predilection of governments to closer settlement that accompanied the bias in favour of irrigation. With minor variations, both the irrigation and closer settlement biases were bipartisan, reflecting community attitudes of the time. In particular, the emphasis on closer settlement meant that irrigation was not used to reduce production risks in livestock industries. Even today, drought assistance reduces opportunities for irrigation farmers to make profits during droughts. The high proportion of small farms in irrigation settlements lessened the economic contribution of irrigation and created economic and social problems that resonate to the present day.

In the past, many products of irrigation had to be assisted through a variety of restrictions on production, trade and marketing. Horticultural products in particular suffered from high labour and transport costs. Almost all product-related assistance given to irrigation farmers has been eliminated, although some relics of statutory marketing persist in the rice industry. An interesting and researchable question is the extent to which the bundling (aggregation) of farm-gate returns for rice with off-farm receipts from rice processing and marketing has affected resource allocation in irrigated areas of southern New South Wales. Ironically, the Government of New South Wales that now pesters irrigators in so many ways is steadfast in its support of the single desk for rice. A case of the green right hand not knowing what the regulatory left hand is up to. State-owned rural water authorities formerly granted various concessions to farmers. These organisations were characterised by cost padding and overmanning similar to other government instrumentalities that became candidates for reform. Government departments responsible for irrigation usually saw themselves as custodians of irrigators' rather than community interests. The careless way Australian irrigation was developed exacerbated environmental damage from salinity, both on-farm and downstream.

All these features combined to make irrigation, especially water pricing, a natural target in the agenda of microeconomic reform that has developed over the last couple of decades. One of the themes of this paper is to explore reasons why water has been treated so differently in the debate and implementation of microeconomic reforms measures, compared with other former publicly owned utilities. A central idea of microeconomic reform was that Australia's economic performance would be enhanced with lower prices for inputs such as electricity, gas, telecommunications and rail transport traditionally provided by government enterprises. This generalisation was applied to business inputs and domestic consumers. An exception is

invariably made for water because it is taken for granted that water was priced too low previously, rather than too high. No such general conclusion should have been made about urban water. Dwyer (2005) has surmised that past rural water policy failures in irrigation are being used to justify the punishment of urban water users. The green hair shirt mentality of parts of the environmental movement provides part explanation of political support for higher urban water prices. By and large, urban water authorities have remained in public ownership. Treasury officials have never been shy of providing rationalisations for revenue-raising measures, however questionable. While previous investment in irrigation may have occurred with undue haste and without proper assessment, that is no excuse for superficial economic analysis at the present time.

Changing technology on-farm and off-farm has had dramatic effects on the productivity of modern irrigation farms, reducing the initial handicap of low labour productivity. But it is not easy to transform the existing capital structure of irrigation, on-farm and off-farm. As pointed out by Godden (2005), retrofitting existing capital can be very expensive. Further adoption of modern irrigation technology would have major consequences for the number of farms in irrigated districts. For much of the last few years, price movements have been benign for major irrigated commodities like dairying and until recent sharp falls, wine grapes. As witness the difficulties being experienced by Australia's vegetable industries in competition with imports, the harsh logic of comparative advantage still applies to agricultural production. The idea that the future of Australian irrigation (and agriculture generally) is in further processing and the production of high value products for export markets is as far off and far-fetched as it ever was. In any case, the objective should be institutional arrangements that enable farmers and others to make their own decisions about what they produce from the available water without any call for ill-informed barracking from the sidelines, however well intentioned (Pratt 2005).

Whereas most of the deficiencies of water policy used to be concentrated in irrigation, the boot is now on the urban water foot. There have been several successes in the reform agenda for irrigation, especially following the introduction of water trading. The Cap introduced by the Murray-Darling Basin Commission in the mid-1990s recognised that water extractions from regulated rivers could not be increased indefinitely. Many changes occurring in the urban water sector in recent years do not stand up to close examination. In an echo of the past, drought and water shortages in urban areas have unfortunately become an excuse for poor public policy. In fact, the approach to water pricing in most states is now more disciplined and logical for bulk irrigation water than it is for urban water, which in several respects is being treated as another opportunity for disguised taxation. Public authority dividends and other imposts are levied, ostensibly in the cause of environmental protection.

Controls on water use in urban areas are arbitrary and amount to little more than a de facto restriction of the innocent pastime of gardening. There is an unpleasant whiff of the latter-day green wowser in many contemporary attitudes of state governments to urban water. Exhortation and expensive advertising campaigns about water saving are the order of the day. Block water pricing arrangements being introduced in some Australian cities are regressive and inequitable. Water recycling is promoted without objective analysis of its costs and benefits. Urban water was always a different case to irrigation in the agenda of microeconomic reform. The previous differences are now reversed, and magnified.

Water use efficiency – an unwelcome diversion and dead end in water policy

Unfortunately, romanticism, a narrow view of economic efficiency and a leavening of anti-empiricism are still prevalent and damaging in water policy, despite all the rhetoric about water use efficiency and environmental flows. The preoccupation with water use efficiency has been especially unproductive. There are at least a couple of reasons for this. Invention is the mother of necessity. There is always a queue of enthusiasts with grandiose technical solutions wanting to solve economic and political problems. This suits politicians and special interests in the water industry as it avoids facing up to decisions that are politically unpopular. Running away from buyback of irrigation licences is an obvious example. The marketing hype and superficial advertising of urban water saving campaigns avoid facing up to financing issues for new dams, and those parts of the environmental movement who have foolishly set their face against new dams in all circumstances.

Economic efficiency is not the same as technical efficiency. The efficiency of water use is often expressed in terms of 'production per unit of water', a criterion as partial and unsatisfactory as 'production per unit of land' that fuelled early interest in irrigation. Marginal valuations are important not calculation of average efficiency. A lot of resources have been invested in dubious measurement of water use efficiency that has neglected other determinants of the pattern of agricultural production (Bryan and Marvanek 2005). At best, these are data gathering and data massaging exercises, rejigging information already in the public domain to satisfy the information needs of unqualified and under resourced catchment management authorities, searching for ideas and a role in environmental management. At worst, benchmarking and calculations of water use efficiency are sheer quackery.

Misuse of the concept of water use efficiency has been damaging in policy development. The worst result has been undue concentration on the commodities produced with irrigation water, rather than the volume of water used and off-farm effects of irrigation. The latter are legitimate concerns for public policy. Fundamentally, water use on farms that does not have off-farm effects is the operator's own business. That is, unless we have returned to another era of central planning in irrigation. Rabbiting on about how water is used on farms has unnecessarily alienated irrigation farmers and set back the course of reform. Rice and cotton are the favourite targets of would be irrigation planners.

Confusion amongst scientists over simple ideas from economics is bad enough but the contagion has now spread to the principal Commonwealth Government Department responsible for agriculture. In its 'Stocktake' of the Australian Agriculture and Food Sector, the Department of Agriculture, Fisheries and Forestry (2005) said at page 6 under the meretricious heading 'Natural resources are critical to agriculture':

> The value of output per unit of water used in agriculture varies considerably across the different agricultural commodities. For example, in 1996-97 (the latest year for which data are available) it was estimated that there was $200 000 (gross value) of rice produced per gigalitre of water used, while at the other end of the scale there was around $1.6 million of vegetables produced per gigalitre of water used…

This statement completely ignores the demand side. On-farm production decisions also depend on the other resources available to the farmer. Concentration on rice growing in southern New South Wales is largely a product of past settlement and irrigation policy.

A variant of the confusion over water use efficiency is neglecting the international dimension of Australian agriculture. In many quarters, there is gross misunderstanding of price formation for irrigated commodities sold on world markets (Foran, Lenzen and Dey 2005; Wentworth Group 2002, 2003). Thus, it is claimed that Australian water prices should include the costs of environmental damage ('externalities') and that these costs could be passed through to consumers. The market does not work this way for commodities whose prices are determined on export markets. Additional charges would fall on farmers.

The Wentworth Group (2003, p.15) goes even further and wants 'a labelling system to let consumers choose in favour of environmentally friendly products that don't guzzle excessive amounts of water.' How the labelling scheme would deal with products grown under natural rainfall and irrigation is not elaborated. No doubt a well-crafted marketing campaign would recruit a few gullible and affluent Australian consumers but the idea of water-based product labelling is completely irrelevant to international purchasers of Australian products that lose their identity in foreign trade.

The consequences of higher water prices for farmers should be acknowledged and not dressed up as a benefit to the environment. In any case, market prices for water as revealed by water trading are now far more relevant to farmers in on-farm decision-making. Including the costs of externalities in prices charged by water authorities would make little difference to production decisions, even if it could be done successfully. Setting bulk water prices should concentrate on the performance of rural water authorities and not be sidetracked by irrelevancies (to pricing) like the environmental effects of irrigation.

Not all of the concern with water use efficiency has been created by environmental interest in water saving or misunderstanding by scientists of how decisions are made on Australian farms. The idea that water is frequently 'wasted' is now part of popular belief. The involvement of the businessman and philanthropist Richard Pratt in the controversy over water use efficiency and water saving came from a slightly different direction. Mr Pratt started from the (defensible) position of wanting to increase Australia's population (Pratt 2005). On his own admission, environmentalists persuaded Pratt that water supplies were insufficient to achieve this objective. But the conclusions of his informants about water and the limits to Australia's population are incorrect.

The standard reference work on Australian water resources is explicit that water is not a binding limit to Australia's population (Smith 1998). Pratt and many others have missed the point. Australian water resources would be sufficient to support a larger human population, if there were sufficient investment in urban water supplies. Effective supplies of urban water would also increase with a changed distribution of the population, and, most obviously, if the amount of irrigation were reduced. Instead of throwing in his lot with those encouraging transfers of water from irrigation to boost urban supplies, Pratt has put his faith in engineering solutions to improve water use efficiency in existing irrigation areas.

Relying on engineering solutions to save water implies that irrigation water is not only being used to produce the 'wrong' commodities, irrigators use the 'wrong' technology to do so. Farmers are free to choose the irrigation technology they use on their farms. The value of output will be a major determinant of their choice of irrigation technique. The market for water creates plenty of incentives for water saving by farmers and water authorities. Within limits, water can already move to its best use.

There is no doubt that Australian irrigation is based on a low level of technology compared to other rich countries. International comparisons are fatuous because the products and markets of Australian irrigation are different to elsewhere. A high proportion of irrigation water is supplied in large gravity irrigation systems through open channels. Losses do occur. Whether these losses are all worth saving is another question? Some of the losses through seepage return via groundwater. Surface run off from farms (return flows) is part of the supply for irrigators downstream. In a subtle and largely unnoticed[1] paper exposing the gross exaggeration of the potential for water saving, Gyles (2003) demonstrated the extent of double counting of losses from the irrigation system. It is one of the oldest mistakes in the economic book to confuse stocks and flows.

A simple rule of thumb can be applied in thinking about the market potential for water saving by investing in new irrigation technology. Direct pumping from regulated rivers occurs for many major horticultural developments for a variety of products. These greenfields operations use the best irrigation techniques on-farm with modern layouts, but do not pump much beyond 15 kilometres from the river. On this reasoning, there is not much future in piping water to produce lower value products on existing farms, set up for flood irrigation. Why pipe water to be used in flood irrigation?

There is no reason to believe that financial institutions are unwilling to lend for private investment in irrigation, including water saving projects. The growth of irrigated horticulture, viticulture and dairying over the last fifteen years is evidence of that. Special financial vehicles for investing in water saving as advocated by Pratt Water (2004) are not required.

Special interests and other conflicts over water

Past enthusiasm for irrigation created an amalgam of interests that were dependent on irrigation and a formidable pro-irrigation lobby. A notable achievement of the irrigation lobby has been to maintain virtual separation of urban and irrigation water supplies. This has occurred even though the era of public investment in irrigation development is at an end, and there are water shortages in many Australian cities and provincial towns. Canberra is an extreme case of the adverse effects of the separation because urban water is drawn from the Murrumbidgee irrigation catchment. Water could be provided to Canberra at low cost. Other cities would require substantial investment to access water now used for irrigation, but the underlying principle is the same. Recent suggestions that irrigation and urban markets for water be interconnected have been treated as newsworthy. The obligation to justify continued rigid separation of irrigation and urban supplies should be the other way around.

[1] But not by those involved in a crude attempt to suppress this excellent work.

The Victorian Government White Paper (2004) on water had a few timid lines at page 119 recognising the advantages of interconnection of water supply systems but did not mention accessing irrigation water as an option for Melbourne. Some Victorian provincial towns adjacent to irrigation water supplies are even more disadvantaged. With around 70 per cent of water extracted from regulated rivers and streams used for irrigation and around ten per cent for urban use, modest transfers of water to cities or towns could not seriously jeopardise irrigation. Instead, profitable opportunities for trade would arise that would benefit irrigators, individually and collectively. To think otherwise is to misunderstand (or obfuscate) the simple economics and arithmetic of water use in Australia.

Opposition to water trade between irrigation and urban use is concentrated in sections of the irrigation industry that are, or regard themselves as, the beneficiaries of present arrangements. An 'every last drop' counts mentality is advanced when it is inevitable that some irrigation water is being used in low value uses, at the margin. Spurious arguments about 'multipliers' and dire economic consequences for country centres if any less water were available for irrigation are bandied about. The every last drop mentality of irrigation organisations – but not all irrigators – unfortunately finds a ready hearing in political circles. Much the same rhetoric is being used to beat urban consumers over the head with crass advertising campaigns about water saving. The political influence of negative environmentalism has been influential in the debate over urban water. So much so, governments are reluctant to invest in new dams for urban water. By definition, this is a foolish position to take. It was always absurd to have a non-empirical and unquestioning view of irrigation in its expansion phase. The same applies now to blind opposition to dam construction or other extensions to the urban water supply system, or profitable investment in irrigation for that matter.

Environmental organisations are major players in the contemporary debate over water. That some environmental damage is caused by irrigation is uncontroversial and should have been appreciated from the outset, Yet, the historical record is clear that past advocates of irrigation development ignored warnings based on then knowledge of potential adverse effects of irrigation (Barr and Cary 1992). Damage has occurred from irrigation through salinisation of irrigation areas, river salinity, decline of native fish populations, degradation of wetlands and riparian and floodplain vegetation. Many aspects of the environment have improved because of river regulation. Flood control is an example. Certainly, amenity has been vastly improved for active and passive recreation on water storages, and weir pools in many towns on regulated rivers.

River health is an archetypal environmental problem where multiple attributes and uses of the environment have to be reconciled. Lack of information is ubiquitous in environmental disputes. A vigorous debate has occurred on the extent to which irrigation development should be wound back. Although the issue has been around since at least the mid-1990s following the Murray-Darling Basin Commission Cap on water extractions, the debate was intensified by the 'Living Murray' exercise of the MDBC in 2002-03 culminating in the National Water Initiative of 2004. The Living Murray had a bad start with a glossy and unconvincing discussion paper published by the Murray-Darling Basin Ministerial Council, slap bang in the middle of a drought. Catchphrases like 'one Basin, one river system and one environment' did not inspire reductionist observers or hard-bitten farmers alike.

Arguments about environmental flows are usually cast in terms of an annual (average?) amount of water to be returned to the 'environment' to restore river health in all its dimensions. The MDBMC document proposed reference points of 350 GL. 750 GL and 1500 GL for the 'community' and agencies to consider. Even higher proposals had been suggested earlier, generating fears among irrigators that the reference points were the thin end of a green wedge. Fine sounding words about 'community engagement' are small comfort when changes are being proposed that will reduce irrigators' incomes without any indication of their scale or method of implementation.

The judgements first proposed in the Living Murray documents were based on purely technical criteria. But what should be more important is having a logical process for water to be returned to the environment combining technical and economic information. Thankfully, the outline of a better process for reconciling conflicting interests is coming together.

Technical criteria on their own are inadequate in determining environmental flows. The 'environment' of rivers and streams, like other parts of nature, exists only in the contemplation of its users. Three important ingredients were missing in the recent debate over environmental flows. First, costs need to be evaluated, especially costs to irrigators of less production. Many steps can be taken to improve riverine environments with vastly different implications for cost. Some steps are related to flow per se and can be achieved by buyback of licences or water savings. Other measures require expensive engineering works.

Second, a valuation process is required to measure the environmental benefits of increased flows. Otherwise, we are at the mercy of political, bureaucratic or scientific whim. Unfortunately, there was reactionary opposition in the Living Murray process from parts of the bureaucracy frustrating plans to conduct comprehensive valuation studies. Gillespie and Bennett (2004) describe methods that could be used to value biodiversity gains and losses. These methods cannot be applied without cooperation of scientists and economists. Formal valuation techniques are based on sampling but do not preclude other methods of community consultation where the interests of those directly involved are considered explicitly.

Third, the timing of the return of water to rivers is important. Some strategies for environmental improvement – sustaining red gum forests, for example – only need water supplies intermittently. Sensibly, this water would be supplied in wetter years. Opportunities exist for profitable deals via temporary trading between irrigators and environmental agencies in making these exchanges.

The political difficulties of the Living Murray exercise arose in part because the objectives of those proposing change were not clear. The scientific basis of the case for environmental flows was ambiguous, or at least extremely difficult to communicate. Furthermore, governments were reluctant to declare the extent of changes envisaged and how they would be financed and implemented. Community consultation became a charade.

What should be the point of reference for investment in environmental changes? Nature in its original state or improvement of measurable aspects of the environment from an existing base. The latter approach that might be called 'environmental rationalism' is gradually becoming embodied in official policies. And is the only valid way to proceed in the long-

term. None the less, the former unrealistic and essentially non-empirical conception of the environment, referred to as 'environmental fundamentalism' by Marohasy (2004), is lurking behind some campaigns and claims put forward by the political environmental movement.

The line of least resistance to populist environmentalism is in the city, where most of its adherents live. Farmers are well organised and well represented politically. The dispersed interests of urban dwellers in rational outcomes on environmental flows have had to take their chance between the vigorous lobbying efforts of the green end of town, and the entrenched position of the irrigation lobby. Part of the problem is that the professional base of state environmental agencies has been eroded in the last twenty years. Independent assessments by academics and other researchers have also been diminished by excessive reliance on grants-based funding.

Environmental battles have brought about defensiveness on the part of irrigators, sometimes to the point of denying any scientific data that confirms loss of biodiversity or damage to the riverine environment on regulated rivers. For example, surveys of river red gums and black box along the River Murray demonstrate a significant change in tree health over a short period (MDBC 2005). Defensiveness is partly understandable because genuine progress has been made in reduction of salinity levels and other environmental indicators (Marohasy 2003).[2] It would be surprising if otherwise, given the scientific effort that has taken place to improve the environmental condition of the Murray-Darling system involving substantial public and private expenditure by farmers. Farmers have actively collaborated in the development of Land and Water Development Plans with state agencies.

Cost sharing, property rights and environmental levies

An ambiguous notion 'cost sharing' has had a life of its own in discussion of Australian environmental policy. But on closer examination cost sharing is another expression of standard concepts from public finance, whenever division of responsibility for revenue raising and expenditure has to be determined for the public and private sectors. There was no need to develop a separate body of literature pertaining to the environment. Debate over taxation and public expenditure has been going on for centuries. Theories of taxation in a mixed market-based economy concentrate on three issues – efficiency, equity and costs of administration, including costs of tax collection and private compliance. These are the paramount issues that should be analysed in determining expenditure on the environment and how it is financed.

Like many questions in the theory and practice of taxation, there is no unambiguous answer on cost sharing or as put by Pannell (2004) "who should pay for the environment?"

[2] Marohasy (2003, p.22) unfortunately appears to have fallen into the trap of confusing stocks and flows by claiming that the actual percentage of water used by irrigators relative to the Murray-Darling system's total potential capacity has only increased marginally from 1950 to 2002. The idea of a 'mature water economy' with the sustainable yield for irrigation close to its limit has been around in Australia for almost twenty-five years (Randall 1981). Increased storage capacity does not affect sustainable yield.

In the usual treatment of cost sharing a distinction is drawn between 'beneficiary pays' and 'polluter pays'. Sometimes these terms are called 'victim pays' and 'impacter pays' respectively. Polluter pays requires that costs should fall on those who cause environmental damage. Beneficiary pays requires that the beneficiary of a good or service should pay for its provision. Polluter pays is favoured as a funding principle because polluter pays creates an incentive to change behaviour. This would be a straightforward except that it is not always possible to identify the proximate cause of damage. Unlike manufacturing industry, non-point pollution and long lags characterise environmental damage to land and water resources. Sometimes it is not possible to recover the costs of remedial action from the polluters. Beneficiary pays then becomes the preferred funding principle by default. If the direct beneficiaries cannot be identified and/or costs of environmental damage readily recovered through charges then the obligation falls on government. The role of government is further convoluted in Australia because of the federal system and the multiplicity of Commonwealth, state and regional agencies.

In short, cost sharing and funding for the environment is a mess where special pleading and the self-interest of recipients and funders is a matter of course.[3] Pannell concluded that "the intrusion of politics is inescapable." What can be done to limit ad hoc decision-making so that politics, parochialism and the power of lobbying do not have complete sway? Economics does have something useful to say about the distinction between existing environmental problems and the potential problems of new developments. According to Pannell, "precedence [should be given] to the status quo. Polluter pays would be applied to prevent a change to a more polluting activity, while beneficiary pays (or an approximation to it in the form of government funding) would be used to encourage a change to a more environmentally friendly outcome." Economics is also relevant to efficiency aspects of environmental expenditure. Unfortunately, arguments over cost sharing have often taken precedence over benefit-cost analysis. There is no point arguing over cost sharing for inefficient projects (Read Sturgess and Associates 2000, pp.37-9). This is especially so when the best strategy is to do nothing because environmental damage is unrepairable, or not worth repairing.

Not only is it difficult to decide who is the polluter from a technical perspective, the political economy of environmental policy is confounded by the previous role of all levels of government. Governments were intimately involved in land development and irrigation through policies promoting closer settlement. The development ethos was reinforced until recently by taxation incentives for land clearing and water-related expenditure, with little regard for environmental consequences.

Cost sharing is a question of who has the 'rights' to determine what happens to the environment. Arguments over property rights in water have come to the fore in the current debate over environmental flows. Two distinct points of view can be recognised. Conscious of the possibility of arbitrary reduction in their existing rights by governments under pressure from parts of the environmental movement, irrigator interests favour more secure property

[3] Australian environmental policy is badly in need of a refined critique along the lines of that provided so elegantly by Ted Sieper (1982) for agricultural marketing. That is, to explain apparently odd government interventions and assistance from a distributional perspective.

rights. Their argument is generally couched in terms of the benefits to investment of greater certainty. Macintosh and Denniss (2004) put a contrary view in an interesting paper published by the Australia Institute. The basis of their argument is that property rights in water are not absolute but derived from licences granted by state and territory governments. "Governments actually own Australia's water resources, not the farmers" (Macintosh and Denniss, p.v). Why should farmers have rights that are not available to others? These authors argue environmental repair should be considered another cost of doing business and the responsibility of the landowner. This is effectively the situation that applies in the manufacturing sector.

Arguments concerning the property rights of irrigation farmers are seriously compromised by the recent firm commitment of all Australian governments to water trading. Transactions have been entered into with existing circumstances in mind. A pragmatic response is necessary for good results in environmental management. Macintosh and Denniss (2004, p. vi) concede that their strictly legalistic approach would have high "political costs" and that there may be grounds for discretionary assistance on equity grounds if property rights are restricted " having regard to the nature of the restrictions, the treatment of other property rights, and the circumstances of the affected farmers and communities" (p.54). This is to enter the realm of politics, in the manner of Pannell's observations on the inherent subjectivity of cost sharing.

Some environmental commentators have introduced further complications by supporting environmental levies. Hypothecated levies have been fashionable in recent years. The Wentworth Group (2002, p.16) toyed with an environmental levy of one per cent added to income tax. The "primary purpose" would not be to raise revenue but raise awareness and change behaviour. This allows the Wentworth Group the luxury (and cheek) of claiming they are "not advocating another new tax."[4] The head of the peak environmental organisation in Victoria, Environment Victoria (Paul Sinclair) also supported a levy to be collected by supermarkets (ABC Online, 2004). The implication is that supermarket proprietors would actually pay, not noticing that the tax would fall squarely on consumers.

Crean (2003) analysed in some detail the case for environmental levies pointing out inter alia that levies challenge the taxation principle of keeping separate decisions about revenue and expenditure. Crean concluded that was "little basis for the environment to be made a special case and excluded from the normal budget process where all funding decisions are routinely assessed against changing community demands."

[4] The Wentworth Group has been given an easy time, especially by metropolitan newspapers. An exception is a stimulating paper by Lane, McDonald and Morrison (2004) that highlighted the tension in the Wentworth 'Blueprints' between commitments to regional 'participation' and creation of "a business-like national Natural Resource Management Commission" (Wentworth Group 2002, p.3), sidelining the states who have constitutional responsibility for land and water management and more technical capacity to implement policies than Commonwealth agencies. The Blueprints are another example of the modern penchant for sophisticated exercises in public relations, safe in the knowledge that only a handful of people will ever read the documents cover to cover.

Natural monopoly, water infrastructure and pricing

Water supply networks could only be duplicated at substantial cost. The water industry is a classic case of natural monopoly with all that entails. The water industry exhibits increasing returns (decreasing costs). Like all infrastructure, water infrastructure generates external benefits that cannot be easily captured through simple user charges (Lim and Dwyer 1999). Because the marginal cost of network usage is much lower than the average cost, private investors would be reluctant to invest in infrastructure if only able to charge marginal cost. At the other extreme, there is the possibility of exploitation of monopoly profits by private owners – hence, the alternative traditions of public ownership or regulated private ownership. The standard Australian response to natural monopoly in infrastructure was public ownership. For irrigation, the public sector rapidly became involved because of failure of early private investments in irrigation, such as the Chaffeys at Mildura (Barr and Cary 1992). Municipal or metropolitan authorities managed urban water. There were state government rural water authorities servicing irrigated settlements and private pumpers on regulated rivers.

Urban water and irrigation water have always been different cases. The political economy of urban water was different from natural monopolies for telecommunications, gas and electricity where prices were linked closely to consumption. Water pricing was based on fees linked to property values with only a limited volumetric component. Pricing favoured residential users at the expense of commercial and industrial users. The average business paid around fifteen times as much for water as the average household (Industry Commission 1992). After the era of expansion of basic services had passed, government enterprise in urban water was beset by the usual problems of cost padding and overmanning, with these costs falling on consumers. State governments were able to raise dividends from urban water authorities and charges for the amenity provided by waterways. Public authority dividends have grown rapidly in recent years (Lim and Dwyer 1999). The Victorian Government White Paper (2004) extended disguised taxation of urban water users further by advocating a five per cent 'environmental levy' on urban water. There have been some institutional changes for urban water in the era of microeconomic reform often involving the separation of water storage and catchment management from retail distribution. With variations between states, urban water remains in public ownership administered by government-owned corporations.

Social objectives in the development of irrigation precluded monopoly pricing. Instead, economic difficulties experienced by irrigation farmers meant that subsidisation of water prices was necessary. The water reform agenda has led to changes in institutional arrangements for delivery of irrigation water. These arrangements are now different in Victoria and New South Wales. There is private ownership of retail distribution systems in New South Wales supplying bulk water to irrigators. The Victorian system has been regionalised but is still firmly in public hands. With different institutional arrangements on either side of the Murray, this provides an interesting case study in microeconomic reform.[5]

[5] Issues of interest include labour productivity of corporatised and privatised authorities, and performance in developing and implementing cooperative arrangements with farmers to manage environmental problems. Their independence and ability to stand up to government flirtation with dodgy regional development proposals is also worthy of close examination

The debate over the pricing of irrigation water was muddied by the loose position advanced by the Council of Australian Governments (CoAG) (1994) on 'cost recovery', also described as 'full cost recovery' (Watson 1995, Lim and Dwyer 1999). General aspects of the CoAG water reform agenda such as separation of service provision from resource management, encouragement of trading and recognition of the environmental consequences of irrigation were positive and uncontroversial. Cost recovery has a ring of economic and fiscal rectitude but there is more to cost recovery than meets the eye. A private firm in a competitive industry has to recover costs to stay in business but there are no guarantees that any rate of return will be earned on investment. Whether past investments are successful depends on operating costs and demand when the investments come to fruition. Cost recovery has more to do with accounting and revenue collection than it does with the economics of resource allocation.

Infrastructure pricing is beset by two difficulties: charging for capital and making good the deficit that would occur if prices were set at marginal cost. CoAG failed to draw distinctions between costs incurred before and after the event of investment. A rate of return was advocated when most of the capital tied up in water infrastructure is sunk and has no alternative use. In practice, a rate of return is collected on urban water but not bulk water for irrigation.[6] CoAG did not appreciate the difference between capital and recurrent costs. Pricing should be forward-looking. What irrigation schemes cost to establish is only of historical interest. In a mature water economy, the task is maintenance. Increased prices of irrigation water cannot bring forth additional supplies. As mentioned above, water trading has superseded any demand management role for prices. Water is not allocated by bulk water prices.

The most well developed approach to pricing of bulk water is that of the Independent Pricing and Regulatory Tribunal of New South Wales. In essence, the position adopted by IPART is that the price of water should be set to sustain the long-term businesses of water supply authorities. This requires that direct operating costs are covered by charges and financial provision is made to keep the capital stock intact, while maintaining a satisfactory level of service. IPART (1996) resisted the temptation to change a rate of return on existing assets.

The outstanding debate in bulk water pricing is between charging for capital by a renewals annuity or a building block/regulatory asset base (RAB) approach. Renewals annuities have been favoured so far. Renewals annuities provide for medium to long-term cash requirements for renewal, refurbishment or replacement of existing infrastructure (Frontier Economics 2005). A capital charge for expected expenditure is raised up-front. With a RAB, the business finances investment and then recovers the cost from users. The RAB requires assessment of proposals when they occur and places more discipline on price determination. There is a danger that money collected for renewals will be spent irrespective of the merits of the investment. Far greater demands are placed on regulatory authorities by renewals annuities. A danger to the public of the RAB approach is that faced with a major capital expenditure, government will succumb to pressure from irrigators and fund unwise investment.

[6] Dwyer (2005) points out that metropolitan water systems were financed by loans. These loans have been paid. Dwyer refers to Professor Bob Walker's conclusion that there are not many businesses where you can get your assets given to you by taxpayers and consumers and then turn round and demand a return on money you never had to outlay.

Water trading and its advantages

Water 'ownership' belongs with the Crown. The traditional system of water allocation tied the entitlement to use irrigation water to land. Allowing transferability of the entitlement to use water since the early 1990s has encouraged the use of water in 'higher value' uses. Water trading has led to greater economic efficiency in water use. Higher value use has often been thought of carelessly as production of higher value commodities. This is a narrow view of the economics of farm production in similar fashion to the superficial approach to water use efficiency, discussed earlier. Product price is just one determinant of the value of water. The marginal value of water on a farm also depends on fixed inputs in the short-run – capital, land and labour, technology and prices of substitute inputs. Farmers choose production techniques and plan their output taking all factors of production into account. A higher value use from the viewpoint of the farmer is not necessarily producing higher priced products. This is confirmed by actual experience of water trading. Water has not always moved from low value to high value commodities.

A legacy of closer settlement policies in the older irrigation districts is many small farms of low productivity. But there is a lot more to structural adjustment than mere consolidation of blocks and increasing size per se. Flexibility in the use of all resources is required, especially labour. Saving labour is often more important than saving water for investment in new techniques of production. Timing of exit is of the essence for individual farmers planning to leave agriculture at some time. Water trading is a valuable tool in structural adjustment because it gives farmers more choices and control over the use of their assets. Some farmers, for example, have gained from selling water on the permanent market and continuing farming by buying on the temporary (annual) market.

Despite populist claims about the emergence of water barons with water trading, water trading is far more equitable and supportive of the aspirations of small irrigators than the previous rigid system (Musgrave 1996).[7] Trade in water also allows irrigators to manage the risks of wet and dry years. Low flexibility users with perennial plantings will be buyers in dry years and sellers in wet years. Higher flexibility users with annual crops will be sellers in dry years and buyers in wet years.

Attitudes to water trading are subject to bias, from different directions. There is still knee jerk opposition to trade from a few who do not like the adjustment pressures arising from market processes. Frequently, there is self-interested opposition to trade from those who want to restrict trade in order to lower prices. This is because the growth objectives of buyers rather than sellers are favoured by low prices for water, at least in the short-term. Almost by definition, buyers and large users of water are influential in irrigators' organisations. This

[7] Talk of 'water barons' emerging in irrigation industries was common following one-sided and ignorant television programs in 2002-3. Monopoly power in irrigation water (as distinct from water infrastructure) is out of the question because of the risks involved. Most water is used in industries where Australia is a price taker on world markets. Monopolists would also need to be weather prophets to manage the substantial financial risks of investing in water. A putative water baron could easily become money barren.

makes excessive reliance on the contemporary fashion for ‘consultation’ and ‘community engagement’ in sorting through the maze of remaining restrictions on trade – interstate, intertemporal, interregional, permanent versus temporary– extremely problematic from the standpoint of the public, and many irrigators.

Extensive research by Bjornlund (2003) using price and quantity data on water trade has established that trade in water has behaved in accord with the predictions of economic theory for inputs to production like water. Bjornlund analysed prices on temporary and permanent markets and found that the prices were subject to the same underlying causes – expected product prices, and substitutes for irrigation water like natural rainfall, or grain in the case of the dairy industry. Temporary prices were more variable because of weather influences.

The upshot of Bjornlund’s findings is that many of the remaining restrictions on trade are futile. In practice, farmers are finding ways around restrictions. The economic efficiency consequences of restrictions in these cases are then small. For example, it makes as much sense to think of permanent trade as a substitute for temporary trade as vice versa. Restrictions on permanent trade with unrestricted trade in temporary water have minor effects. Leasing of water is now common, formally or informally. Transactions in land can be substituted for transactions in water. The issues for public policy are the transaction costs of trade and any environmental effects of trade. Existing restrictions add substantially to the transaction costs of trade. Fixed transactions costs fall heavily on small water trades. Large buyers and sellers have brokers acting on their behalf to handle the paper work. Getting rid of some restrictions on trade is a question of equity as well as economic efficiency.

After years of a rigid control, hesitancy was inevitable in the evolution of water trade. Some constraints placed on water trading have bad effects. Intertemporal trade (carryover) is allowed in southern New South Wales but not in northern Victoria. Autumn irrigation of annual pastures has stopped in New South Wales but continues in Victoria because there is no opportunity to use water in the following spring or summer. Only limited progress has been made on separating the right to own water from the right to use water. Water ownership should be allowed for third parties increasing the liquidity of the water market. There is no more reason to tie water ownership to owners of irrigable land than there was to tie water use to particular parcels of land. Third party ownership of water would also have the advantage of allowing environmental groups to own and use (or not use) water.

Permanent interstate trade has been allowed on a trial basis between Victoria, New South Wales and South Australia in pumped districts from Nyah to the Murray Mouth. The trial has demonstrated that all three states can manage environmental clearances for large horticultural developments. Continuing restrictions on permanent interstate trade between Victoria and New South Wales outside the Mallee are an artefact of institutional arrangements. Companies hold the water licence on behalf of the individual farmer shareholders of the privatised irrigation companies in New South Wales. Existing articles of association of the companies preclude disposal of permanent water. Freeing up this market would require legislative changes. Taking a long view, directors of these companies will want to sell permanent water at some time.

Differences between states in the way various aspects of irrigation are administered such as pricing should not be allowed to impede interstate trade. Interstate trade is free, as it is supposed to be, in a multitude of goods and services that are administered differently in different states, in the public and private sectors. This is akin to poor arguments supporting stringent anti-dumping provisions in world trade.

Further opposition to trade comes from water authorities and local interests because of fears of 'stranded assets'. Stranded assets may be off-farm infrastructure (for example, channels) or on-farm delivery systems. More notice has been taken of this issue than justified. Generation of some stranded assets is just what advocates of water trading were looking for. Irrigation was often located in the wrong places because of initial carelessness in testing for soil types and so on, causing environmental damage through water logging and salinization. Shifting water to safer locations is a plus not a minus. Stranded assets are more like a success indicator than a valid reason for slowing down the transfer of water through voluntary exchanges. Proposals for 'exit fees' to be paid when water is shifted from one area to another have no counterpart in other areas of commerce. Plenty of other assets are left 'stranded' by social and economic changes. Stranded assets in irrigation reflect the fact that water is being used more profitably elsewhere.

The transition from plan to market is not easy. Gradualism is indicated. Liberalisation of the water industry in Victoria left corporatised rural water authorities with an obligation to supply those already connected to the network. Some parts of the irrigation system now need to be closed down because water has traded away and remaining infrastructure needs to be maintained, or even replaced. An absolute duty of supply threatens the financial stability of water authorities, and remaining irrigators. This is a challenge to price regulators because some irrigators may prefer to avoid closures by paying more and keeping facilities operating. Once infrastructure is sunk, the appropriate rule is to charge for variable costs including agreed standards of maintenance. Negotiation between water authorities and irrigators is the best way of solving problems of stranded assets.

A raft of studies has indicated that off-farm engineering and on-farm investments in water use efficiency are a costly way of finding water savings (ACIL Tasman 2003; Goesch and Heaney 2003; Gyles 2003). Buying water for environmental purposes is an attractive proposition in many circumstances, that is, if the proposed environmental uses of water have been properly analysed, technically and economically. If the environment is to have defined rights to a share of water, the next interesting question is how environmental entitlements and environmental trade should be managed? An independent environmental manager would seek to trade temporary water between seasons taking into account wet and dry years and timing requirements of different environmental strategies. It is not clear whether present provisions of the National Water Initiative would allow temporary trade, because the agreement is written in terms of permanent water entitlements.

Politicians and environmentalists resist buyback of licences and development of trade in environmental water. Politicians responsible for the environment do not want to account to their colleagues for environmental programs. Environmentalists know that public support would diminish if it were known environmental flows came at substantial cost. Ambit claims for the environment are easier with budgetary and other costs hidden from view.

Access to water – the case of Lakes R Us

Liberalisation of the irrigation industry and the introduction of water trading have had predictable consequences. Greater private rights to water imply that irrigators will seek greater influence on the actions of others that they regard as having deleterious effects on their operations, or potential operations. Musgrave (1996) anticipated that the initial success of water trading would lead to development of markets in other scarce resources such as storage airspace.

The National Competition Council is now considering an application by Lakes R Us Pty Ltd for access to storage airspace in the Snowy Scheme, confirming Musgrave's prediction. The application is opposed by Snowy Hydro Limited, the corporatised operator of the scheme owned by the States of New South Wales and Victoria and the Commonwealth Government. The New South Wales Government is the majority owner of Snowy Hydro and the principal participant in the dispute. Victorian irrigators, as mentioned, cannot carryover water. How it might be stored does not enter their thoughts.

As a matter of engineering, the Snowy Scheme is a separate Snowy-Murray development and a Snowy-Murrumbidgee development. New South Wales' irrigators draw water from both. The political compromises necessary to get the scheme established required legal sleights of hand using the defence powers of the Commonwealth, in peacetime (Watson 2005). This case is one for legal aficionados rather than tyros of agricultural economics. Its legal significance is far greater than its economic significance.

The following comments are based on the NCC Issues Paper, submissions by Lakes R Us and Snowy Hydro obtained from the website of the NCC, plus a perceptive opinion piece by Alan Moran published in the Melbourne Age on July 4, 2005. There is no attempt to assess the legal arguments and precedents that have to be considered by the NCC. Nor is there any attempt to judge whether Lakes R Us would have a successful business in the event its application were successful.

Moran's article goes well beyond the access issue pointing out quirks in the electricity market post-deregulation, especially following the introduction of renewable energy certificates, as part of the Commonwealth response to greenhouse/climate change. It turns out it can sometimes pays Snowy Hydro to pump water uphill (with a pointed stick?), using coal-fired off-peak electricity to earn extra renewable energy certificates from the high-priced peak electricity that is generated when water later flows downhill. Snowy Hydro can use almost two times as much coal-derived energy as it produces in subsequent generation of hydroelectricity. This is not what the renewable energy policy intended and, as Moran suggests, is anomalous and wasteful deserving separate investigation irrespective of any aspirations of Lakes R Us. On the numbers given by Moran and other information in the NCC Issues Paper, the profits obtained by Snowy Hydro from machinations involving renewable energy certificates would swamp revenue at stake in the application of Lakes R Us.

It is hardly surprising that Snowy Hydro seek to preserve maximum flexibility in generating electricity while meeting minimum obligations to supply water to irrigators. Prima facie, Snowy Hydro has no incentive to actively develop a storage function. Who owns the water in the scheme is an overriding question? Do the rights of irrigators to use water apply on both sides of the dam wall?

The Issues Paper sets out the tests and precedents that need to be considered by the NCC. these consist of a mixture of complex legal arguments that also require economic judgement. Hydroelectricity generation is usually described as a 'non-consumptive' use of water. How that fits in with Snowy Hydro's claim "that the Council's power to make a recommendation to the Minister in respect of declaration of the water storage and transport service is prohibited because it is part of a production process" (NCC 2005, p.11) is a challenging question? A physicist might give different (correct) answer to a lawyer.

Some of the arguments being put by the parties to the dispute stretch common sense and lay intuition. Thus, Snowy Hydro argues that obscure swamps near Griffith, or untested CSIRO technology to store water in aquifers, are potentially alternative storage possibilities that could substitute for the much larger Snowy Scheme.[8] It is hard to believe that "it would be economic to develop alternative water storage and transportation facilities" (Snowy Hydro 2005, p.2)

The 'promotion of competition' test raises issues that are more within the purview of economists. Snowy Hydro already lends water to irrigation companies in New South Wales, effectively providing a storage function. Snowy Hydro definitely is in the box seat in price negotiations over these transactions. Presumably, this was a driving force behind the creation of Lakes R Us.

Formal or informal leasing of water provides intertemporal flexibility to irrigators. As stated in the preceding section, irrigators have a range of water trading, production, financial and marketing strategies available for risk management. Would one more make much economic difference?[9] But is that the point? If Lakes R Us loses money doing something judged legal, does it matter how the risk management/storage function is performed?

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[8] Lakes R Us throw in 'climate change' as if it were a trump card at a couple of points in their submissions, reminiscent of the Victorian Government White Paper on water. Even if perfect forecasts were possible for the Australian climate, it would be a small part of the story. Effects of climate change on agriculture in other countries are just as important to irrigators. A flexible irrigation policy is needed for all contingencies, irrespective of the outcome of climate change. Snowy Hydro plays an environmental card of sorts saying, "to allow the release of water to be subject to the arbitrary decisions of private individuals would be contrary to the public interest of protecting the environment". (Snowy Hydro 2005, p.4) Even the NCC indulges itself with a rhetorical flourish by saying "the Snowy Scheme is recognised as one of the seven civil engineering wonders of the modern world" (NCC 2005, p.25). Like the ancient wonders, good to look at and serving symbolic and spiritual purposes.

[9] The argument evokes the idea of a 'law of constant risk' from the literature on agricultural finance. Farmers have a range of risk management instruments. If one is subject to change, then it is possible to adjust other instruments to restore the desired level of risk.

Concluding comments

Water has frequently been flavour of the month in Australia, and a brackish flavour at that. Most of the irrigation infrastructure now in place would not have been constructed without the fervour for national development based on irrigation. A reckless approach to investment in irrigation was followed in the past, resulting in a situation where Paterson (1987) judged that only twelve per cent of the land in irrigated production in 1987 would have been developed on economic criteria.

An objective of this paper has been to point out that all is not it what it seems in contemporary water policy. Some progress has been made in the reform of irrigation but there are outstanding issues in irrigation and urban water. Raising revenue rather than resource allocation has distorted the agenda of microeconomic reform in urban water pricing. An erroneous concept of water use efficiency has pervaded water policy discussion and distorted the water research agenda. Prospects for water saving through investment in irrigation infrastructure have been grossly exaggerated.

More progress has been made in irrigation water pricing. Bulk water for irrigation is now priced rationally in the major irrigation states of Victoria and New South Wales. The approach to water pricing and regulation of groundwater and water taken from unregulated streams is still deficient. Richard Pratt was correct in recognising that the priority given to measurement and monitoring of water use in Australia is insufficient. The standard of groundwater administration is poor. Groundwater and surface water are continuous. Managing one and not the other is a travesty of water administration. For water pumped from unregulated streams and groundwater, metering is the exception rather than the rule.

A turning point in the retreat from the pro-irrigation bias of the expansion phase of irrigation scheme was the controversy over Commonwealth support of the Ord River Scheme in the early 1960s. It was demonstrated that the scheme was not economically justified although the support given to the Ord did achieve its political objectives. Perhaps some progress has been made in public understanding of the water industry. The political success of the supporters of the Ord River Scheme was not repeated in the bizarre far canal episode of early 2005, when the Western Australian Opposition tried unsuccessfully to persuade the electorate to support an extravagant proposal to transport water over large distances to supply urban water to Perth.

A negative influence on improvement of water policies has been excessive reliance on consultants' reports instead of strengthening the policy development capacity of public institutions. Grants-based funding will not deliver on the expectations of the community for improvement environmental and water management. The Commonwealth and state governments are getting in each other's way offering grants for water saving. The guidelines for the Water Smart Australia Programme that are part of the National Water Initiative (National Water Commission 2005) inspire no confidence. The same goes for the Victorian Water Trust, whose approach to investment was described as 'holistic' in the 2003 Green Paper on water that preceded the Victorian Government White Paper.

Market-based policies hold out the best hope for improvement in policy development. Command and control mechanisms are seldom applicable for irrigation because most environmental problems are non-point. Modern theories of the economics of information are pertinent. Policy-makers do not know enough about the economic and technical dimensions of protecting and repairing the environment to make well-informed decisions. Information is unequally held between the parties to environmental disputes. Decision-making can be improved with an experimental approach designed to bring together these separate pieces of information.

A younger generation of professionals is moving in the right direction. It is a pity that politicians and other agents of influence cannot keep up. Even in the modern era, politicians find it difficult to restrain themselves when under pressure from irrigation interests. A gold-plated replacement of Torrumbarry Weir on the Murray River downstream of Echuca was built in the mid-1990s, when lower-cost options based on pumping were feasible for parts of the system supplied from Torrumbarry. In the event, much of the water that was previously used for irrigated pasture has traded from the Torrumbarry district to horticultural and viticultural developments in Victoria and South Australia, based on direct pumping. The Victorian Government also supports the (well-named) Deakin Project in Sunraysia; a project intended to be mainly based on irrigated grape production. Consultants' budgets of potential on-farm development were based on (irrigated) wine grape prices of $700 per tonne (SMEC and Psi-delta 2001). Current prices are lucky to be half that. More to the point, private investors are capable of making investments in large horticultural projects. The role of government should be restricted to environmental approvals. There is no economic case for direct involvement.

Further afield, the Government of Queensland is proceeding with construction of the Paradise Dam on the Burnet River against the advice of officials. Again, there was shoddy analysis by consultants that either ignored or completely misinterpreted demand considerations. The dam was supposed to be justified by production of high-priced fruit and vegetable products for the Australian domestic market. These markets are already adequately supplied from nearby parts of Queensland. Additional output of fruit and vegetables would depress prices. In South Australia, the record is also mixed. It has taken aeons to act on polluting and unprofitable government-controlled irrigation on dairy farms on the Murray Swamps, in recreational areas close to Adelaide.

References

ABC Online, 'Levy mooted for Murray food.'
http://www.abc.net.au/news/newsitems/200503/s1333944.htm

ACIL Tasman (2003), *Scope for Water Use Efficiency Savings as a Source of Water to Meet Increased Environmental Flows – Independent Review*, Report to the Murray-Darling Basin Commission, Canberra.

Barr and Cary (1992), *Greening A Brown Land: The Australian Search for Sustainable Development*, Macmillan Education, Melbourne.

Bryan, B. and Marvanek, S. (2004), *Quantifying and valuing land use change for Integrated Catchment Management evaluation in the Murray-Darling Basin 196/97 – 2000/01: Stage 2* Report to the Murray-Darling Basin Commission, CSIRO Land and Water Client Report.

Bjornlund, Henning (2003), 'Empirical Evidence of Factors Driving Prices Paid, Volumes Traded and Number of Transfers in Permanent and Temporary Markets', Section 2 of Draft Final Report for ARC-SPIRT Project, 'Elements of the Next Generation of Water Market Policies, which are Socially Equitable and Ecologically Sustainable Within Rural Communities.'

Council of Australian Governments (CoAG) (1994), *Report of the Working Group on Water Resources Policy: Communique*, February.

Crean, J. (2003), 'Agri-environmental conservation – the case for an environmental levy', paper presented to the 47th annual conference of the Australian Agricultural and Resource Economics Society, Fremantle, February. (http://www.agric.uwa.edu.au/ARE/AARES/News/Con_Spg_2003.htm)

Davidson, B. (1965), *The Northern Myth*, Melbourne University Press, Melbourne.

———— (1969) *Australia Wet or Dry: The Physical and Economic Limits to the Expansion of Irrigation*, Melbourne University Press, Melbourne.

Department of Agriculture, Fisheries and Forestry (2005), *Stocktake: Australian Agriculture and Food Sector*, Canberra.

Dwyer, T. (2005), 'The Economics of Water Supply – Scarcity or Abundance', mimeo.

Foran, B, Lenzen, M and Dey, C. (2005), *Balancing Act: A Triple Bottom Line analysis of the Australian Economy*, Volume 1, CSIRO and University of Sydney.

Frontier Economics (2005), *Review of pricing policies prepared for Goulburn-Murray Water*, Melbourne.

Gillespie and Bennett (2004) 'Linking Science, Community Consultation and Economics: The Living Murray Project', paper presented to the 48th annual conference of the Australian Agricultural and Resource Economics Society, Melbourne, February.

Goesch, T. and Heaney, A. (2003), *Government Purchase of Water for Environmental Outcomes*, ABARE eReport 03.22.

Gyles, O. (2003), 'Valuing benefits of increasing water use efficiency', paper presented to the 47th annual conference of the Australian Agricultural and Resource Economics Society, Fremantle, February. (www.agrifood.info/connections/autumn_2003/Gyles.html)

Godden, D. (2005), Review of 'Economia: New Economic Systems to Empower People and Support the Living World', by Geoff Davies, *Australian Journal of Agricultural and Resource Economics*, 49 (2). 233.

Independent Pricing and Regulatory Tribunal of New South Wales (IPART) (1996), *Bulk Water Prices: An Interim Report*, Sydney, October.

Industry Commission (1992), *Water Resources and Wastewater Disposal. Report No. 26*, Australian Government Publishing Service, Canberra.

Lane, M. McDonald, G. and Morrison, T. (2004) 'Decentralisation and Environmental Management in Australia: A Comment on the Prescriptions of the Wentworth Group.' *Australian Geographical Studies*, 42 (1), 103-115.

Lim, R.K.H. and Dwyer, T.M. (1999), *Infrastructure Pricing, Provision and Process: Implications for Rural Australia*, RIRDC Publication No. 99/162, Rural Industries Research and Development Corporation, Canberra.

Macintosh, A. and Denniss, R. (2004), *Property Rights and the Environment: Should farmers have a right to compensation?* Discussion Paper Number 74, Australia Institute, Canberra.

Marohasy, J. (2003), 'Myth & the Murray: Measuring the real state of the river environment,' *IPA Backgrounder*, 15 (5).

_____ (2004), 'Environmental Fundamentalism', *Policy*, 20 (3), 41-45.

Moran, A. (2005), 'It's all a big snow job', *The Age*, Melbourne, July 4.

Murray-Darling Basin Commission (2005), *Survey of River Red Gum and Black Box Health along the River Murray in New South Wales, Victoria and South Australia – 2004* (Brett Lane and Associates: Ecological Research and Management), MDBC Publication No. 06/05.

Murray-Darling Basin Ministerial Council (2002), *The Living Murray: A discussion paper on restoring the health of the River Murray, Stage 1: Informing and engaging the community*.

Musgrave, W. (1996), 'The Irrigation Industry in the Murray-Darling Basin and Aspects of its Reform', in J.J. Pigram (ed.), *Security and Sustainability in a Mature Water Economy: A Global Perspective*. Armidale, Australia: University of New England, Centre for Water Policy Research.

_____ (2000), 'The Political Economy of Water Price Reform In Australia', in Ariel Dinar (ed.), *The Political Economy of Water Price Reforms*, Oxford University Press, A World Bank Publication, 299-319.

National Water Commission (2005), *Water Smart Australia Programme Guidelines*, Australian Government Water Fund, Water Smart Australia.

Pannell, D. (2004), 'Thinking Like an Economist 4: Who Should Pay for the Environment?' *Pannell Discussions* No. 21. 11 October. Available on the net at http://www.general.uwa.edu.au/u/dpannell/pd/pd0021.htm

Paterson, J. (1987), 'The Privatisation Issue: Water Utilities', in Abelson, P. (ed.), *Privatisation: An Australian Experience*, pp. 181-204, Mosman, Sydney: Australian Professional Publications.

Pratt, R. (2005). Address to Water Summit, March 30 2005.

Pratt Water (2004), *The Business of Saving Water: The Report of the Murrumbidgee Valley Water Efficiency Feasibility Project*, December.

Sieper, E. (1982), *Rationalising Rustic Regulation*, CIS Research Studies in Government Regulation 2, Centre for Independent Studies, St. Leonards, N.S.W.

Randall, A. (1981), Property Entitlements and Pricing Policy for a Maturing Water Economy, *Australian Journal of Agricultural Economics*, 25 (3) 195-220.

Read Sturgess and Associates (2000), *Rapid appraisal of the benefits and costs of nutrient management*, prepared for the Department of Natural Resources and Environment.

Smith, D. I. (1998), *Water in Australia: Resources and Management*, Oxford University Press, Melbourne.

Snowy Hydro Limited (2005) 'Briefing Paper to the National Competition Council', 24 February.

Snowy Mountains Engineering Corporation and Psi-delta (2001), *Alfred Deakin Irrigation Project Feasibility Study*, Volume 1.

Victorian Government White Paper (2004); *Securing Our Water Future Together: Our Water, Our Future*, Melbourne.

Watson, A.S. (1995), *Conceptual Issues in the Pricing of Water for Irrigation*, Dairy Research and Development Corporation, Melbourne, December,

_____ (2005) 'Airport Environmentalism', Review of Claire Miller, *Struggle for the Snowy: The Grassroots Campaign to Save a National Icon*, *Agenda* (forthcoming).

Wentworth Group (2002), *Blueprint for a living continent: a way forward from the Wentworth Group of concerned scientists*, WWF (World Wide fund for Nature) Australia.

_____ (2003), *Blueprint for a national water plan: the Wentworth Group of concerned scientists*, WWF Australia.

APPROACHES TO INCREASING RIVER FLOWS[*]

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Introduction

There is now considerable competition between those wanting water for irrigation and those wanting water for environmental purposes. This is not just competition for water; it is a competition of ideas and interests. The purpose of this paper is to introduce some of the underlying controversies in the debate over water use in Australia. Irrigation is by far the dominant use of water in Australia. There have always been major questions about the efficiency of water use in irrigation. These questions are not diminished by the growing demands for water in the competing use of providing environmental goods.

The motivation for irrigation development in Australia is explored in the next section of the paper. It turns out that past political enthusiasm for irrigation was based on unsubtle conclusions drawn from rudimentary observation of the Australian climate and a partial appreciation of the economic possibilities of agricultural production in Australia.

The next two sections of the paper are concerned with contemporary environmental issues following from past development of irrigation. The principal conclusion is that increasing river flows is only a possible means to some environmental objectives, but not an end. Moreover, environmental policy-making is about choice. Without procedures for valuing environmental benefits and costs, environmental policy-making could degenerate into capricious exercise of the recently acquired political influence of environmental groups, not unlike the excessive influence of the pro-irrigation lobby in the previous development phase of Australian irrigation.

A common reaction of observers of Australian irrigation is to regard environmental problems as technical issues, neglecting the human and economic dimensions. One consequence is undue emphasis on water saving which is often counter-productive in pursuit of environmental objectives. These naïve proposals are elaborated in the penultimate section of the paper. A brief conclusion follows.

Background to Irrigation in Australia

Irrigation remains a contentious area of public policy in Australia even though large-scale irrigation development ended around thirty years ago. The contemporary role of government in dealing with the environmental consequences of irrigation is perhaps as problematic as the role of government in the creation of irrigation schemes. Irrigated settlements were first established in Australia for mainly social reasons. Early attempts to develop private irrigation schemes were unsuccessful and had to be taken over by governments. Doubts had been raised concerning the economic role and management of irrigation long before the environmental consequences of irrigation became matters of

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public concern. When governments were prepared to subsidise irrigation, irrigators were unconcerned with the operational efficiency of the system. Until recently, neither irrigators nor governments were particularly concerned with the effects of irrigation on the environment. The politics of irrigation is also sensitive, involving longstanding disputes both between the States and between the States and the Commonwealth. Furthermore, the change of community attitudes to irrigation is relatively recent. This is especially difficult for irrigators who have gone from public favour to disfavour in the space of a generation.

Prima facie, irrigation was an uncontroversial response to problems of agricultural production in an arid country like Australia. Average rainfall and runoff are lower and more variable than in other countries. Average rainfall in Australia is 455 mm over the landmass and runoff is only 52mm. Australia accounts for 5 per cent of the world's land area but less than 1 per cent of global river runoff (Smith 1998, p.4). Variability of rainfall, measured by the coefficient of variation, is around twice that of Europe. Low and variable rainfall was an important motivation behind the development of irrigation in Australia. Even today, the episodic occurrence of major drought brings forth suggestions for new irrigation developments. Most bizarre was the suggestion in 2002 from parts of the business community and entertainment industry that coastal rivers should be turned inland! This is despite environmental problems of long-established irrigation schemes and economic problems of the most recently developed schemes in northern Australia.

The outcome of past public and private investment in irrigation is that seventy per cent of Australian water use is for irrigation and 9 per cent for other rural uses. The remainder is for domestic purposes (12 per cent) and commercial/industrial use (9 per cent) (Smith 1998, p.86, Australian Bureau of Statistics 2000, p.8). These data are for water drawn from rivers, streams and underground aquifers. Far more water from natural rainfall is used where and when it falls.

Around 30 per cent of the value of agricultural production in Australia is produced with irrigation (Hall and Watson 1999). In other words, 70 per cent of the value of production is produced from natural rainfall in dryland agriculture.

As a rich professional literature attests, the popular enthusiasm for irrigation over a century or more was always inconsistent with a serious appraisal of physical or economic opportunities facing Australia (Davidson 1969, Campbell 1980). Davidson, turning superficial comparisons based on rainfall per unit of area on their head embodied in the abuse of language that Australia is a 'dry continent', observed that Australia had much more water per head of population than most other countries. Although political controversy over the role of irrigation reached its zenith in the discussion of the Ord River scheme in the 1960s and 70s, the arguments of the critics of irrigation were more general and not limited to the peculiar difficulties of irrigation in remote northern Australia.

Around half the irrigation water is used in the production of pastures for livestock – that is, around a third of the water used in Australia. Yet, pastures, unimproved and improved, are the basis of dryland livestock production. Australian agriculture is characterised by abundant supplies of land and sparse supplies of labour. Irrigated production is generally more labour intensive than dryland farming. Capital costs of investment in irrigation

storages and other infrastructure are higher than in other countries because of low and extremely variable rainfall in catchments. Therefore, prospects for large-scale irrigation in Australia based on the economics of comparative advantage were, and are contrary to perceptions based on average climatic experience. Davidson and other critics also centred on the demand features of some irrigated products. Markets for horticultural products are limited by the high transport costs of perishable products. In any case, long-term demand trends favour fresh rather than processed horticultural products.

The upshot of these negative features of irrigation was that irrigated agricultural products like rice, dairying and dried vine fruits had much higher rates of assistance through home consumption price schemes and other policies than the major products of dryland agriculture (wool, meat and cereals). In the past, irrigation was frequently characterised by production of subsidised outputs using subsidised inputs. For this reason alone, assistance to irrigation was bound to be re-assessed in the era of microeconomic reform even without simultaneous recognition that Australian irrigation had become a 'mature water economy' (Watson and Rose 1980; Randall1981). A mature water economy is characterised by exploitation of the best sites for irrigation headworks and development of associated irrigation canals and distribution facilities necessary to supply irrigation areas. There is more competition for water among irrigators. Increased recognition of environmental requirements and the need for reform of institutional arrangements and management of irrigation are other features of the mature water economy. In economic terms, irrigation water has reached the stage of steeply rising marginal cost.

The history of irrigation in Australia is intertwined with questions of settlement policy and government assistance in financing of infrastructure. The historical pattern of closer settlement makes adjustment of farm area difficult. The abiding principle of settlement was to put as many farmers on the land as possible; the egalitarian concept of the 'home maintenance area' that condemned early settlers to a frugal existence and contributed to adjustment problems that persist to the present day. The history of irrigation in Australia is closer to the 'command and control' model of collectivist farming and central planning than is generally recognised. Ideas such that irrigation should pay its own way or that farmers should be responsible for their own decisions about water use and production plans are only recent. Like collective farming, planning in irrigation was not all it was cracked up to be. And it will be argued in this paper that 'planning' in the narrow sense of the word is a poor way of dealing with the environmental consequences of irrigation.

Somewhat paradoxically, the end of the era of expansion of irrigation has coincided with generally higher prices and profitability of irrigated industries (dairying, wine, rice and cotton) than dryland farming industries (wool, meat and cereals). This has increased demand for water for irrigation and exacerbated arguments about the environmental consequences of irrigation. Moreover, reform of assistance arrangements and some progress in reform of water pricing has meant that the recent expansion of irrigated production has occurred on a much more commercial basis than was previously the case.

Environmental Concerns

The focus of political interest in irrigation has shifted one hundred and eighty degrees with increased emphasis on water quality and other environmental aspects of irrigation. Environmental concerns are an amalgam of the physical, the biological and the aesthetic.

Physical problems include frequent closure of the Murray mouth with the need for costly dredging. Biological phenomena include more frequent toxic algal blooms and decline in the number of native fish. Aesthetic appreciation of rivers and their environs is distinct from the instrumental requirement for clean water for drinking and of irrigated food production for human consumption. Nevertheless, this source of demand for environmental services also comes from people, not 'nature' per se. Unlike the demand for food, demand for environmental services increases with increasing income.

Some environmental phenomena can be readily valued in the market but there are serious difficulties in the valuation of the non-market costs (and benefits) of irrigation. Environmental policy-making involves difficult choices between diverse projects for environmental remediation. One of the toughest is deciding the sequence in which projects are implemented when there is a mixture of market and non-market benefits and costs. For example, investment in restoration of native fish requires changes right along the regulated river system if fish are to have passage to the sea. There is a mix of benefits attributable to appreciation of the existence of 'natural' phenomena and angling benefits for recreational fishers. By contrast, wetlands adjoining rivers can be improved or restored one-by-one, including artificially in some cases by pumping. Moreover, the benefits of investment in wetlands are observable by a far wider population than is the case with improved fish management.

The idea of artificial wetlands is disturbing to those whose concept of the 'environment' is based on restoration of a 'natural' order with environmental flows designed to simulate the original seasonality, duration, height and frequency of floods. Given all the changes that have occurred in river management to date, this objective is only partly attainable. Nor would it be desirable from a human perspective given the dependence of many towns and cities on water supply from a regulated river. Partial recovery of wetlands and enhancement of other environmental assets will involve direct controls by river managers on a reach-by-reach basis on the inflow and outflow to wetlands rather than relying on average annual volumes of environmental flows per se. As remarked by Coman (2003, p.86), disagreements on the objectives of environmental policy "have to do with the very nature of our understanding of the term ecology and, in the final analysis, come down to opposing philosophical ideas which are as old as our civilisation itself."

There are direct economic benefits of a regulated river system apart from irrigation. Notable examples are flood control and the recreation and amenity provided by water storages in catchments and weir pools in irrigation districts. Non-market valuation is conceptually and empirically feasible but unconvincing to non-economists. Nonetheless, unless the valuation aspect is properly acknowledged, argument over environmental flows will descend into public relations and political contests with exaggerated claims by irrigators and environmentalists. Without collaboration between scientists and economists – and especially transparent processes of decision-making – environmental choices could be determined by scientific preferences for fish life over bird life (or vice versa) and/or random political processes following from the location of swinging seats.

The environmental problems of the Murray-Darling basin have become the subject of frequent newspaper comment and urban discourse. This is in part the result of contemporary fashion and continuing urbanisation but there is little doubt that that the development ethos that sustained past political support for irrigation has passed into history. A stark example of the changed public attitude to irrigation is the recent controversy over increasing environmental flows in the Snowy River. The campaign to return water to the Snowy was successful, albeit favoured by unusual Victorian electoral circumstances. Nevertheless, the outcome depended on support from the Commonwealth and New South Wales Governments.

It is inconceivable that a campaign to divert large amounts of water from irrigated areas would have even been taken seriously by the community or governments twenty years ago when the Snowy Mountains Scheme was politically popular. Just as politicians once felt a dam coming on at election time, it seems that in the future they could make just as many ill-considered decisions about increased environmental flows.

Environmental flows

Debates over irrigation and the environment usually concentrate on the extent to which water supplies are over-allocated and overused. However, 'flow' should be an instrument of environmental policy rather than a target. Nor is it self-evident that environmental problems associated with irrigation should have higher priority than those associated with dryland agriculture. In debates over environmental flows, there is usually insufficient recognition that all the demands placed on the irrigation system by irrigators and environmentalists are not simultaneously achievable. The debate will eventually have to be settled by compromise. As pointed out by Paterson (1985, p.192), "there is no optimal solution, policy or plan in the absence of a demonstrated feasible optimal solution. That makes the sustainable yield issue central." The 'how' as well as the 'how much' question also has to be considered in the context of recovering water for environmental flows from consumptive uses like irrigation.

Sustainable yield is a much more difficult concept in practice for irrigation than other applications in natural resource management. The variable rainfall and hydrological features of Australian catchments are a far cry from stationary trees and fish populations whose growth characteristics can be accurately described and modelled. And no one would claim that forestry and fisheries were unbridled success stories. Forestry management has been an administrative and political disaster in Australia.

On purely physical measures, irrigation in the Murray-Darling Basin river system is close to hydrological, economic and environmental limits. Information provided in the State of the Environment Advisory Council (SEAC) report indicates that current diversions are over 80 per cent of the median natural flow to the sea (SEAC, 1996, figure 7.9, pp.7-11). Because continued growth in diversions was judged unsustainable, a 'cap' was applied to diversions of water from the Murray-Darling Basin river system in 1995 based on diversions planned in 1994 (Murray-Darling Ministerial Council 1995). The reason for the cap was declining river health with continuing increase in water diversions. The cap

was reviewed in 2000 (M-DMC 2000). A consequence of this review was introduction of 'end-of-valley' targets to complement the overall cap.

Subsequent to the 2000 review, the Murray-Darling Ministerial Council published 'The Living Murray: A discussion paper on restoring the health of the River Murray' in July 2002. Inter alia, that document proposed (p.29) "annual volumes of 350 GL. 750 GL and 1500 GL to serve as reference points to start community discussion about whether or not water should be recovered from water users for the environment". The first two reference points were to be achieved in ten years and the third over fifteen years. As rough orders of magnitude, these reference points represent around five, ten and twenty per cent of current diversions for irrigation in the southern connected River Murray system (Wentworth Group of Concerned Scientists 2002).

Administration of the cap and similar environmental flow regimes imposed by the states suffers from three major problems.

- Water trading has activated water previously not used for irrigation but held for insurance purposes. Water trading created a negotiable asset for farmers who held water in reserve, just as other assets are held in reserve for risk management. For reasons of law and common sense, farmers holding 'sleeper' and 'dozer' licences have to be treated like 'full-time' irrigators once trading is allowed. The existence of water trading, however, creates the opportunity for water to be purchased for environmental flows.
- Improved irrigation technology changes the technical relationship between consumption and diversion, as water becomes scarcer and more expensive. Especially with flood irrigation, one farmer's drainage water or return flow was another farmer's irrigation entitlement in low technology irrigation systems (Gyles 2003). In effect, improved water use efficiency (WUE) is a mixed blessing for the environment! WUE is discussed in greater detail in the next section of the paper.
- The cost of administration per se. Modern styles of public administration imply considerable investment in consultative procedures. Coupled with endemic disputes between states over irrigation water, the cost of administration of the irrigation system is now a serious problem for all parties. Not all problems can be solved through consultation. This is especially the case when Commonwealth and State agencies are pressing ahead with separate plans for enhanced environmental flows. For example, the cuts in flows anticipated by the Living Murray initiative are over and above reductions in diversions for irrigation in New South Wales that have already been negotiated by River Management Committees.

Even more fundamentally, the essential question should not be flow per se but a more carefully defined and refined concept of river 'health'. Flow, and especially average annual flow, is only one dimension of the problem. More rigorous analysis would also consider pollution by salt and nutrients, intra- and inter-seasonal timing of flows on a reach-by-reach basis. An important dimension is whether previous environmental damage is reversible or irreversible. One hundred years of irrigation has disturbed the 'natural' state of the river. Not all environmental damage is repairable let alone worth repairing.

Improvements in river health should be targeted at achievable goals. This may or may not involve increased environmental flows.

What is missing in much popular environmental literature is recognition that irrigation (and agriculture) in Australia exists in contemplation of a world market. This is major confusion of the Wentworth Group of Concerned Scientists in their recent tract *Blueprint for a Living Continent*. An array of domestic and international factors affects the size and prosperity of agricultural industries. There is no intrinsic reason why farmers should be paid for "environmental services (clean water, fresh air, healthy soils)" as recommended by the Wentworth Group to sustain the existing level of agricultural output. There will always be marginal farms and marginal areas. No pattern of production is sacrosanct in the face of changing economic circumstances or the environmental consequences of agricultural activities. Indeed, the boot could be on the other foot. If farming damages others, taxes on farmers are indicated rather than subsidies. This is most obvious in cases when damage takes the form of pollution of waterways, as is all to frequent from dairy farms. A bad example of pollution by dairy farmers is in the Lower Murray Reclaimed Irrigation Area of South Australia (LMRIA or the 'Murray Swamps'). Even at the present time, the Government of South Australia is spending large amounts on refurbishing an irrigation area that has been discharging pollutants in recreation areas close to Adelaide.

Nor is it sensible or even possible when prices are determined on the world market to "incorporate into the cost of food, fibre and water the hidden subsidies currently borne by the environment" (as so carelessly put by the Wentworth Group when the costs of environmental damage are really borne by *people*, not by the land that is eroded or water that is made salty). On the more substantive point, it is not possible to make consumers in Australia or overseas pay higher prices by taxing farming-induced externalities. Australia is a 'small country' in agricultural trade in all but unusual circumstances. Environmental taxes will fall on producers.

Perhaps this is why farmers' organisations, environmental organisations and their supporters like the Wentworth Group have given the support to environmental levies to be paid for by the community at large. The Wentworth Group have made the disingenuous claim in supporting an environmental levy 'we are not advocating another new tax.' Obviously, an environmental levy is a tax on income. Environmental expenditure should be considered alongside other claims on governments (taxpayers) (Crean 2003).

Paying subsidies to farmers to repair environmental damage could also be a double-edged sword. Second round environmental damage should be considered if farmers are to be compensated for past environmental damage. Moreover, as argued by Crean (2003, p.15):

> …much of the argument for increased public funding of environmental issues, is based on the assumption that the existence of land degradation is itself a sufficient condition for government intervention. Neither the area of resource degradation nor the estimated costs of that degradation provide guidance on whether the problem can be efficiently addressed…
>
> …Assessing the efficiency of increased public funding requires a forward rather than a backward looking approach. Research into the marginal social benefits from addressing particular degradation problems relative to their marginal social costs should be a key priority.

Growing concern with the environmental consequences of irrigation can be regarded as a second stage in an ongoing retreat from an uncritical approach to the economics of

irrigation that dominated public attitudes and the policies of governments until the last twenty years. As noted above, the first stage of this retreat began in the 1960s and 1970s when governments took note of the growing criticism of economists and scientists concerning the way irrigation was established and conducted in Australia.

Government insistence that irrigation and land settlement projects be subjected to serious examination was part of a worldwide trend towards greater use of cost-benefit analysis and other formal techniques of project appraisal. In fact, the water and irrigation industry of the United States was the test bed in development and application of the techniques. Australian researchers and officials were quick to follow. Rapidly emerging problems from the early 1970s of the Ord River scheme in Western Australia that slipped unscathed through the appraisal process reinforced scepticism concerning the economic merits of irrigation and its adverse environmental effects. Cabinet papers released under the thirty-year rule in 1996 confirm that professional advice from public servants concerning the Ord was adverse (Smith 1998, p.171).

In a similar way, there have been recent major developments in environmental economics increasing the chances of improved environmental management. These developments reflect theoretical insights into the economics of information coupled with vastly improved measurement of the scientific dimensions underlying environmental phenomena. The scope for market-based instruments (and more rational regulation) has been enhanced. It would be a pity if a rushed and partial view of the environmental issues surrounding irrigation – focusing on intermediate objectives like increased environmental flows – diverted attention from a full appraisal of the issues using modern analytical and measurement techniques (Bardsley, Chaudri, Stoneham and Strappazzon 2002). Whether this is best achieved through existing institutions or a new National Commission with planning functions run by 'experts' as proposed by the Wentworth Group is a moot point.

Not all conflicts over water and the environment should be taken seriously. Concerns over availability of water per se to consumers in metropolitan and non-metropolitan urban areas are often exaggerated. Water supply to metropolitan areas is not a binding constraint on the size of the Australian population (Smith 1998). Water use by urban consumers is measured in different units to water use by irrigators – by a factor of a thousand! The citizens of Australian capital cities have been gulled into believing that access to drinking water is linked to consumption of water by irrigators. More substantive issues are the loss of amenity by urban residents from irrigation farming and the damaging effects of irrigation on water quality, for farmers as well as urban consumers.

In principle, irrigation in Australia could have been allowed to complement other agricultural and pastoral activities and reduce the inherent riskiness of agricultural production. The writings of Bruce Davidson were explicit on this point. In practice, irrigation settlements were developed based on independent farms that were intended to survive on their own account. Moreover, any contribution that irrigation might have made to drought mitigation in Australia has been lessened by government policies of drought relief that reduce private incentives to prepare for drought. In particular, drought assistance truncates the occasional profits that irrigation farmers could make by supplying fodder to drought-affected areas.

There are still major differences in the irrigation policies pursued by the Australian states. Whereas interstate differences are declining in most areas with increasing Commonwealth influence over all aspects of economic and political life, important distinctions persist between the states in the organisation of irrigation, especially with respect to the security of water supply. In effect, the climatic risks of managing water supplies are predetermined for irrigators.

The traditional system of property rights in irrigation is 'release sharing' whereby irrigators are allocated a fixed volume over a season of the water that is released from a reservoir. As such irrigators are unable to participate in the management of the reservoir. Dudley and Musgrave (1988) demonstrated the in principle advantages of 'capacity sharing.' With capacity sharing, users are allocated a share of inflows, reservoir capacity and losses. In effect, users are then operating their own reservoirs. The major benefit of capacity sharing over release sharing is that irrigators are better able to manage their risks rather than have an arbitrary regime of risk management imposed by reservoir managers.

Victoria runs its system conservatively whereas New South Wales manages its storages on a 'fill and empty' basis. In the Victorian part of the southern Murray-Darling system, irrigated dairying is the dominant enterprise. Dairying does not require the same high security of water supply as irrigated horticulture. Grain and purchased feed can substitute for irrigated pasture. However, dairying is much less interruptible than irrigated cropping industries – rice in the south and cotton in the north – that are important in the New South Wales' part of the Murray-Darling system.

These differences have proved to be an obstacle to development of interstate trade in water. However, a common objection to expanded interstate trade on the grounds that irrigation systems are operated differently in different states is a red herring. Provided irrigators know what it is they are trading, they are capable of determining their own level of risk. Similar to protectionism in the wider scheme of things, objection to interstate trade comes mainly from the officials who operate the existing system and vocal and politically influential irrigators who are on the buying side of the market. The objective of these irrigators is to keep traded prices of water down because it fits in with their growth plans. Sellers of water benefit from high prices but their interests are under represented in the political debate over irrigation.

Economic and technical efficiency in irrigation

The quest for water savings is the most common response to the perceived need to increase environmental flows. Yet, economic efficiency in irrigation is not the same as technical efficiency as measured by the proportion of stored water that is actually used by plants – 'crop per drop' in agronomic parlance. Like all instant and appealing solutions to difficult problems, there is more to WUE than meets the eye.

At times, the reactions have been fanciful. Early in 2002, the Melbourne businessman Richard Pratt proposed that water for expanded irrigation should be brought from the north by turning coastal rivers inland. This was a variant on the Bradfield scheme of the 1930s. Unfortunately, the engineer Bradfield had not accounted for evaporation let alone mundane considerations like costs of irrigation infrastructure and markets for irrigated produce. Mr Pratt went one better by failing to notice that large numbers of Australians

had decided to live in desirable coastal regions in the intervening years. Obviously, these citizens would not appreciate their visual amenity being disturbed. Subsequently, the Pratt proposal was modified to advocate increased water savings in irrigation areas through government (taxpayer) funded piping of irrigation water. Back of the envelope figuring shows that this suggestion is just as implausible. The cost of piping water, sealing channels and the like is more than the value of the water saved.

Gravity irrigation systems so common in Australia do not appeal to those attracted to the high technology irrigation systems observed in countries close to large out-of-season markets for horticultural produce. International comparisons are fatuous. At least, gravity irrigation takes advantage of the habit of water of flowing downhill unlike piped irrigation systems with substantial capital and energy requirements.

Mr Pratt and others are operating with a completely different paradigm. The authority of Nostradamus apparently prevails. Opportunity cost and consumer demand for irrigated output is a burdensome irrelevance (ABC Online, March 14, 2003). It is an affront to workers in the field of irrigation policy that the musings and ravings of the rich and powerful are being taken so seriously.

Among other things, economic efficiency depends on the cost of irrigation equipment, the prices of commodities and the price of water. There are a vast number of irrigation techniques and production systems that will be profitable at any time for different capital and input costs and product prices. A major influence on costs is the resources already available to the farmer. While substitution between inputs increases over time, there are severe limits to farmers' flexibility with irrigation. This is one reason why it is unrealistic to expect that there can be a rapid change in irrigation techniques and water use.

Returns from irrigated crops vary markedly in Australia. In addition, the return to irrigation water varies from season to season and within a year according to natural rainfall and temperature. It follows that simple comparisons of gross margins per megalitre, per hectare and/or per unit of the commodity are no indication of the best use of irrigation water. Market prospects for irrigated products also have to be considered in the context of economic efficiency. A critical consideration is the elasticity of demand. For most exported products, increased output does not have much effect on prices received because Australia has a small share of the market. Increased output of products sold exclusively on the domestic market results in lower per unit returns.

The complexity of substitution between water and other inputs and between products explains why water has not moved in directions expected by bureaucrats and other lay observers following water trading. Talking about 'high value products' where irrigation water should be used was economic nonsense. The information needed to make such judgements is too daunting given differences between farms and farmers. Water should be used in ways ensuring its marginal value is highest, including environmental uses. That principle does not require that some products are favoured in the allocation of water or that prescription of particular techniques of irrigated production is justified. Farmers are best placed to decide how water should be used given their knowledge of their own circumstances and opportunities.

The idea that some industries have 'growth prospects' and others do not is dangerous. Consequently, attempts by the former Land and Water Resources Research and Development Corporation (LWRRDC – now Land and Water Australia) and others to promote particular irrigated products and encourage 'irrigation best practice' through comparative analysis and 'benchmarking' techniques were unwarranted, ignorant and wasteful. This was akin to seeking solutions to housing shortages by finding the number of households with spare rooms (Denis Hussey, personal communication).

The debate over benchmarking and WUE is important because the same ethos is being carried over into thinking about water recovery options to meet targets for environmental flows. Already South Australia is establishing norms for water use in different enterprises. By definition, benchmarking makes comparisons based on the existing pattern of production. The option that a market-based reconfiguration of irrigation is possible in the long-term with a different mix of enterprises and techniques of production is precluded. In effect, land and/or capital would be substituted for water. Despite all the evidence that planners made mistakes in the past, the idea dies hard that they have sufficient knowledge to make the right choices for the future, There are often unanticipated changes in local climatic conditions, technology, input costs and product prices. Planners are clearly disadvantaged in accessing this detailed information and using it in water allocations and production choices compared with individual farmers.

A cynical explanation of political confidence in the efficacy of WUE as a solution to the problem of environmental damage from irrigation is that it avoids facing up to the political and financial costs of increased environmental flows, whether those increases are achieved through purchase or administrative means. In particular, reconfiguration of irrigation would accelerate farm amalgamation with the social disruption that implies. Unfortunately, some scientists are attracted to the chimera of WUE because it generates expenditure on research programs.

More charitably, there are three implicit statements or economic judgements in advocacy of WUE in the discussion of environmental flows:

- Irrigation water is being used to produce the 'wrong' commodities.
- Irrigators are using the 'wrong' technology.
- When irrigators use the 'right' technology, they are slow in adoption.

Behind these assertions, there is the age-old argument whether markets are characterised by rigidity or flexibility. The argument can only be settled by appealing to the evidence. With respect to adoption, Australian evidence favours the case for flexible reactions by farmers. A body of work by Cary and his colleagues has challenged the slow adoption view of farmers with respect to conservation-oriented innovations (for example, Cary and Wilkinson 1997; Cary, Webb and Barr 2002). Farmers are quick to adopt innovations that are profitable, convenient and consistent with their objectives and other resources. A paradigm case of rapid adoption in gravity irrigation was laser levelling – paradigm in two senses, because it challenged the slow adoption thesis and demonstrated that other factors of production are important in farmers' decisions as well as water. Laser levelling is a labour saving technique, as well as water saving.

In the modern version of the planning view of irrigation, criticism of Australia's rice, dairying and cotton industries is ubiquitous. These criticisms ignore the significance of the demand side, always important for an export dependent agriculture. Demands for rice, cotton, wine grapes and dairy products are elastic, unlike many horticultural products. Secondly, decisions by farmers are determined by costs of all resources used in production, not just water.

WUE as a concept is flawed and incapable of precise definition. Technical definitions of WUE like 'crop per drop' might serve some useful purpose in researching production possibilities for irrigated crops but have no economic significance. In fact, useful water saving techniques are being developed through research on irrigation technology; for example, partial root zone drying and regulated deficit irrigation in viticulture.

It would make more sense to turn the argument around and start from estimates of the environmental flows necessary to achieve specific environmental objectives. In that case, it would be necessary to have a valuation process to decide the portfolio of projects and the sequence of return of water from irrigation to the river. Enthusiasts for WUE seem to have missed the point that water markets have been in existence in irrigated districts for more than a decade. The market price of water provides the best indication of what it is worth paying for water savings (Gyles 2003). Without some mechanism to capture water savings for environmental purposes, on-farm savings by farmers are irrelevant.

At least in principle, public investment in off-farming savings offers better prospects than in on-farm savings that are the property of the irrigator. However, just as the extent of slack in farmers' irrigation practices has been exaggerated, water authorities have already been under considerable pressure to make savings for several years. In any case, recovery of water for the Snowy has already exploited the low-cost options for water savings. In effect the political fluke of the election to the Victorian Parliament of an Independent Member for East Gippsland in 1999 has denied the Murray-Darling system cheap sources of water for environmental flows. Further water will have to be purchased on the market.

Concluding Comments

Making better use of water in irrigation and rivers presents several challenges. Perhaps the greatest challenge is to define the limits of public and private economic activity in recovering water for the environment. The pretence that water will be available from water savings off-farm and on-farm should be abandoned forthwith. A market-based approach is indicated with irrigators selling water to the government (or even private groups) for environmental purposes. The precise process for purchasing water is in need of refinement but according to the budget available, this approach would deliver water from willing sellers. As argued by John Freebairn in his companion piece in this forum, government purchase of water would also assist political and community judgements on the value of environmental flows and specific projects.

The sequence of projects has to be determined. What is lacking in much of the environmental literature is the recognition that the sequence of actions is just as important as the content (Watson 2001). A disaggregated view of environmental projects and prospects is required that takes account of consumer preferences for environmental assets in specific locations. The public interest is in off-site effects of irrigation. What happens on individual farms is of no concern to public policy. There should be no place in future irrigation policy for proposals to set up arbitrary performance indicators based on technical efficiency in irrigation. The information necessary to implement such policies is not just unknown, it is unknowable.

Fortunately, the challenge of returning water to rivers for environmental uses is being faced with greater intellectual discipline than in the development phase of Australian irrigation. The danger is an inadequate political response to the new found influence of an unsophisticated environmental lobby that has replaced the earlier unsophisticated pro-irrigation lobby.

References

ABC Online, 14 March 2003.'The World Today – Richard Pratt warns of coming chronic shortage of water.' www.abc.net.au/worldtoday/content/s80728.htm

Australian Bureau of Statistics 2000, *Water Account for Australia 1993-94 to 1996-97*, Canberra (ABS Catalogue 4610.0).

Bardsley, P., Chaudri, V., Stoneham, G and Strappazzon, L. 2002, 'New Directions in Environmental Policy', *Agenda*, 9 (3), pp.211-222.

Cary, J.W. and Wilkinson, R.L. 1997. 'Perceived profitability and farmers' conservation behaviour', *Journal of Agricultural Economics*, 48 (1), 13-21.

Cary, J.W., Webb, T. and Barr, N.,F. (2002). Understanding landholders' capacity to change to sustainable practices: insights about practice adoption and social capacity for change. Agriculture, Fisheries and Forestry Australia, Canberra.

Coman, B. 2003. 'Correspondence', in *Quarterly Essay 9*, Schwarz Publishing Melbourne, 86-90.

Crean, J. 2003. 'Agri-environmental conservation – the case for an environmental levy', 47th annual conference of the Australian Agricultural and Resource Economics Society, Fremantle.

Davidson, B.R. 1969, *Australia Wet or Dry? The Physical and Economic Limits to the Expansion of Irrigation*, Melbourne University Press, Melbourne.

Dudley, N. and Musgrave, W.F. 1988, 'Capacity Sharing of Water Resources', *Water Resources Research*, 24 (5), 649-58.

Gyles, O. 2003. 'Valuing benefits of increasing water use efficiency', 47th annual conference of the Australian Agricultural and Resource Economics Society, Fremantle.

Hall, N. and Watson, W. 1999, *Consultancy on Water Markets, Institutions, Pricing and Infrastructure Issues in Irrigated Agriculture*, prepared for the Australian Academy of Technological Sciences and Engineering.

Murray-Darling Basin Ministerial Council 1995, *An Audit of Water Use in the Murray-Darling Basin*, Canberra.

Murray-Darling Basin Ministerial Council 2000, *Review of the Operation of the Cap: Draft Overview Report of the Cap Project Board*, Canberra, March.

Paterson, J.P. 1985. 'Water Planning: A New Start in Victoria', in W.R.D. Sewell, J.W.Handmer and D.I.Smith (eds) 1985, Water Planning in Australia: From Myths to Reality, CRES, Australian National University, Canberra, pp.121-60.

Randall, A. 1981, 'Property Entitlements and Pricing Policy for a Maturing Water Economy', *Australian Journal of Agricultural Economics*, 25 (3), 195-220.

Smith, D.I. 1998, *Water in Australia: Resources and Management*, Oxford University Press, Melbourne.

State of the Environment Advisory Council (SEAC), *State of the Environment Australia 1996*, CSIRO Publishing, Melbourne.

Watson, A.S. 2001. 'Money and the Environment', *Agenda*, 8 (1), 89-96.

Watson, W.D. and Rose, R.N. 1980, 'Irrigation Issues for the Eighties: Focusing on Efficiency and Equity in the Management of Agricultural Water Supplies', paper presented to the Annual Conference of the Australian Agricultural Economics Society, Adelaide.

Wentworth Group of Concerned Scientists. 2002. Blueprint for a Living Continent: A Way Forward from the Wentworth Group of Concerned Scientists. Worldwide Fund for Nature.