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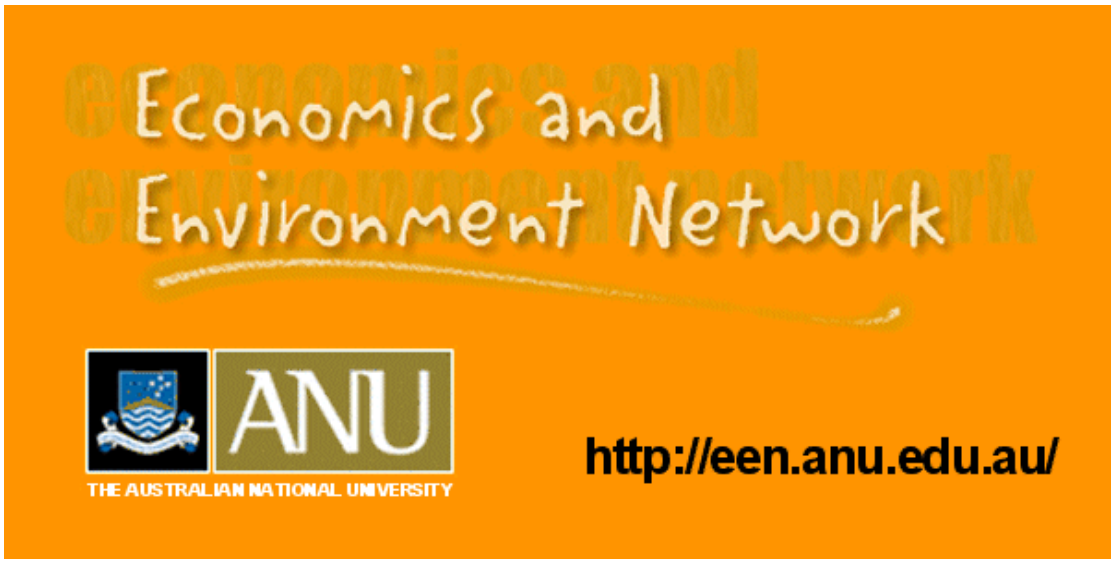

Buying Back the Living Murray: At What Price?

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ABSTRACT

In June 2004 the Council of Australian Governments approved the Intergovernmental Agreement on Addressing Water Overallocation and Achieving Environmental Objectives in the Murray-Darling Basin ('IGMDB'). The IGMDB set out arrangements for a 'Living Murray' that includes a budget of $500 million to return 500 billion litres of water per year to the Murray River by 2009. Unfortunately, two years later and only 11 billion litres have been returned as environmental flows as a result of the initiative. In response, the Australian Government in April 2006 proposed a new scheme to purchase water entitlements from farmers who undertake water-savings measures. We examine this proposal in relation to the general economic principles for the allocation of scarce water. We contend that the latest initiative, although helpful, suffers from two fundamental problems in terms of water pricing. First, the current market price for water entitlements does not include the value of water 'in situ', or the benefits it generates separate from its value in consumption. Second, the constraint imposed that water users undertake infrastructure investments when selling their entitlements unnecessarily raises the cost of returning water to the Murray River. We conclude that the latest scheme to achieve the laudable goals of the 'Living Murray' is not cost effective and that the ratio of litres of water returned to dollars spent could be much higher if the pricing policies were changed.

When the well is dry, we know the Worth of Water.
(Benjamin Franklin *Poor Richard's Almanac*, 1745, p.2)

1. Introduction

The Murray-Darling river system provides critically important water resources for Australia's agricultural sector. Through the use of dams and water diversions the river system provides water for irrigation in Queensland, New South Wales (NSW), and South Australia. Unfortunately, the environmental costs associated with these altered flows have been very large. For instance, a review of the Murray-Darling's ecological condition concluded it was 'significantly impaired' and no longer 'healthy' (Jones *et al.* 2002).

Regulation of the Murray-Darling river system has been in place since the early 1900s, but it was not until the late 1980s that meaningful reforms were attempted to address concerns over the environmental health of the river. A number of policy initiatives have been adopted to address concerns of the environment of the Murray-Darling River system. The most significant, adopted in 2004, is the Intergovernmental Agreement on Addressing Water Overallocation and Achieving Environmental Objectives in the Murray-Darling Basin (IGMDB). The IGMDB sets out arrangements for investing $500 million to return 500 billion litres (1 billion litres = 1 gigalitre or GL) of water to the Murray by 2009. Despite the IGMDG goals as of August 2006 only 11 GL have been returned in the form of environmental flows as a result of this initiative.[1] This lack of progress led the Australian Government in April 2006 to propose the purchase of water entitlements, and to reallocate water back to the river system. While the whole process is

[1] South Australia's Minister for the Murray, Karlene Maywald, is quoted in *The Australian* (21 August, 2006) in a speech delivered on 21 August that her government has purchased 11 billion litres of water for environmental flows in the Murray River that was previously used for irrigation purposes.

entirely voluntary, it is hoped that the financial incentive will induce farmers to adopt water efficiency measures and then 'sell' what will become 'excess' water allocations.

We examine the economic principles for the allocation of scarce water and conclude that a one-sided approach has been adopted in the Australian Government's proposal. In particular, we contend that one, the price of entitlements is too high because it does not account for the 'in situ' environmental benefits of reallocating water to the river and, two, the requirement that water users undertake infrastructure investments to reduce water use as a condition of purchase is not a cost effective way to return water to the Murray River. As a result, much less water will be provided in the form of environmental flows than if water included a price for its non-use, and if there were fewer constraints imposed on sellers of water entitlements.

Our goal is to evaluate the economic and environmental deficiencies associated with the latest water entitlements policies of the Australian Government. In Section 2, we set out the environmental justification for returning water to the Murray-Darling river system, and highlight the significant environmental damage that threatens both ecosystem health and the sustainability of the systems. Section 3 examines the recent history of water reform in Australia, and provides the policy context for the Australian Governments' proposed scheme to purchase water entitlements. We outline the general economic principles for the allocation of scarce water resources, the deficiencies with the current initiative and the policy implications in Section 4. We conclude that sellers of water entitlements should not be required to undertake water-efficiency measures as a condition of sale, and that the market price of water should include the environmental benefits of

'in situ' water to ensure the greatest amount of water is returned to the Murray River per dollar of expenditure.

2. Environmental Water Allocation: Where Markets Meet the Environment

The concept of an 'environmental' water allocation is embedded in Agenda 21 of the 1992 Rio Summit on Sustainability, and has since been reflected in Australian policy responses through the Australian and State Governments' adoption of the principles of ecologically sustainable development (ESD). Rivers, wetlands and groundwater sources have since been recognised as legitimate 'users' of water (United Nations Conference on Environment & Development 1992: Ch 18). The decision, however, over how much water should be maintained for environmental flows is complicated by many issues including the value of water in competing uses, property rights over water access and use, environmental demands that vary over season and years, recreational needs and other factors.

2.1 Environmental Flows[2]

Increasing demand for water in Australia over the last century has resulted in a multitude of water control devices, locks, floodplain levee banks and dams built to divert water from its natural environment to meet consumptive demands, and in the process have interfered with the natural hydrological cycle. Increasing water use poses risks for the environment in terms of resilience to shocks, biodiversity, habitat losses, etc. To balance

[2] Although this paper deals with water management in the Murray Darling, the concepts discussed predate the Murray-Darling Agreement. See, for example, the Macquarie Marshes Management Plan (www.macquariemarshes.com)

these water demands, the concept of a ‘healthy working river’ has been developed that represents a river’s ability to sustain an agreed level of work and an agreed state of health indefinitely. If the level of work demanded from the river reduces the health of the river below what the community desires it is no longer ‘healthy’, regardless of the economic gains we may make in the interim. (Jones *et al.* 2002: 13). The decision to maintain the healthy condition of a river is essentially a social one, involving many stakeholders representing competing interests, on various levels. For instance, upstream communities that are reliant on large river diversions for their living will have different interests to those communities living downstream. Others may also value the water simply for the environmental services it provides, rather than any benefits it generates in terms of direct use.

The effects of altered flow regimes are many. For most rivers, there have been significant changes to the frequency and duration of the times when the rivers and their wetlands are dry or wet, the geographical distribution of floods, and the links with other environmental cycles and events. Schofield *et al*. (2003) identify the following ecological changes in regulated river systems in Australia:

- Massive loss of wetlands — 90 per cent of floodplain wetlands in the Murray Darling Basin, 50 per cent of coastal wetlands in NSW, 75 per cent of wetlands on the Swan Coastal Plain in the south-west of Western Australia
- Decline of riparian forests
- Invasion of dry river channels and former wetlands by vegetation
- Changes in aquatic plant community structure in regulated river reaches and weirs

- Decline in population and species diversity of invertebrates, fish and waterbirds
- Extinctions of several invertebrate species
- Massive blooms of toxic cyanobacteria (blue-green algae)
- Invasions of exotic species of plants (such as water hyacinth), and of fish, especially the European carp

Although most studies have focused on the impacts on surface water resources, in a dry continent such as Australia groundwater also plays a significant role in maintaining diversity of plants and animals that is not independent of river flows.

2.2 The Murray-Darling River System

The Murray-Darling is the longest river system in Australia. It covers just over one million square kilometers, or around 14 per cent of Australia's land area, drains parts of Queensland, the major part of New South Wales, a large part of Victoria and part of South Australia. Compared to other river systems of similar size, the Murray-Darling Basin is characterised by low average rainfall and very high variability in rainfall. As a result, it has a long history of irrigated agriculture and it now supports about 40%[3][4] of the total annual value of Australian agricultural production.[5]

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[3] Murray Darling Basin Commission, *About the Basin*, *http://www.mdbc.gov.au/about/basin_overview*

[4] Other statistics put the annual economic output from the Basin at around AUD$23 billion with AUD$10 billion from agriculture, equivalent to almost one third of the value of Australia's total annual agricultural output. See Global Ministerial Environmental Forum (2004).

[5] Cape (1997) suggests that irrigation accounts for around 25 per cent of the total gross value of agricultural output in Australia, or around $7 billion per year, implying that the share of gross output associated with the MDB would be around $5 billion per year.

The development of agriculture in the Murray-Darling Basin is associated with a range of environmental problems, some of which are specifically linked to irrigation while others reflect more general impacts of agriculture (Quiggin 2001). In July 2002 a detailed investigation of the environmental impacts of flow regulation on the basin was conducted. The expert panel that undertook the investigation concluded the river system could no longer be considered healthy and that '…returning the Murray River System to healthy working condition would require major improvements to river management — more environmental water, improved habitat condition, improved catchment and floodplain management, and better water quality' (Jones *et al.* 2002: 15). These findings on the health status of the Murray River system is illustrated in Figure 1 where the dotted lines represent alternative futures depending on the choices water users and governments make today, and in the coming years (Jones *et al.* 2002: 17).

[Figure 1 here]

Over the last fifteen years, environmental studies have identified a number of significant threats to the Murray-Darling including: land degradation; river water salinity; land salinity; water quality problems; and loss of biodiversity.[6] The Murray-Darling basin is particularly susceptible to river water salinity because the run-off from irrigation increases salt loads, and because the use of water for irrigation reduces *total* flows. A Salinity Audit undertaken by the Murray-Darling Basin Commission (MDBC) in 2000 concluded that, under current policies

[6] Gippel and Blackham suggest the impacts due to water diversions can be divided into: hydrology; geomorphology and water quality; and ecology. For their detailed analysis see Gippel and Blackham (2002)

> the average salinity of the lower River Murray (monitored at Morgan) will exceed the 800 EC[7] threshold for desirable drinking water quality in the next 50-100 years. By 2020 the probability of exceeding 800 EC will be about 50 per cent. (Murray-Darling Basin Ministerial Council 2000: vi cited in Quiggin 2001: 70-71)

Other impacts relate to water quality, in particular turbidity, and eutrophication resulting from excess nutrients such as fertilizer runoff.[8] In addition, the manipulation of the Murray-Darling's flow regime, and the reduction in the volume of water flowing into wetlands, has had a devastating effect on the population and diversity of the river's biodiversity. As a consequence of these effects there have been a number of intergovernmental agreements on water reform for the Murray-Darling, most recently the 'Living Murray Initiative'.

3. The Policy Context: The Living Murray Initiative

A variable climate and low run-off rate have been major influences shaping Australia's water use, with early colonists manipulating water resources as soon as they arrived. These interventions include a multitude of largely government-sponsored water control devices including the construction of 499 damns with walls higher than 10 metres — all to secure reliable water supplies and economic prosperity. (Schofield *et al.* 2003: 6; Ghassemi and White 2006 *forthcoming*: 21) Thanks to these major water management activities, the Murray-Darling River has long played an important role in Australian

[7] The EC unit is a measure of electrical conductivity, commonly used to indicate the salinity of water. 1 EC = 1 micro-Siemen per centimetre, measured at 25°C.
[8] See Dwyer *et al.* 2006. *Irrigation Externalities: Pricing and Charges*. Staff Working Paper. Productivity Commission Canberra. for further details on the externalities associated with irrigation

agriculture. A growing public agitation about the declining environmental state of Australia's largest river system, however, has demanded government attention, and the need for a coordinated approach to the management of the Basin.

The first agreement for the Murray-Darling was signed in 1915 and reflected the overwhelming concern of the day to ensure reliable irrigation flows and the development of irrigation-based communities. The River Murray Waters Agreement, was signed by the Commonwealth, the states of NSW, Victoria and South Australia, and set out the basic conditions for water allocation (Murray-Darling Basin Commission 2000a):

- Flow at Albury is to be shared equally between NSW and Victoria;
- Victoria and NSW are to retain control of their tributaries below Albury; and
- Victoria and NSW to supply South Australia with a guaranteed minimum quantity of water

Over seventy years later, in 1987, the River Murray Waters Agreement was amended by the Murray-Darling Basin Agreement. The purpose of the revised Agreement was 'to promote and co-ordinate effective planning and management for the equitable and efficient and sustainable use of the water, land and other environmental resources of the Murray-Darling Basin'(Murray Darling Basin Commission 2000a: Ch 1).

In 1992, a new Murray-Darling Basin Agreement superceded the River Murray Waters Agreement, and was given full legal status by the *Murray-Darling Basin Act 1993* passed by all the contracting governments. Queensland became a signatory in 1996, and in 1998 the Australian Capital Territory (ACT) formalised its participation through a Memorandum of Understanding. The Agreement consolidated the co-ordinated approach

to the Basin, and established new institutions at the political, bureaucratic and community levels to underpin its implementation:

- the Murray-Darling Basin Ministerial Council (MDBMC), the decision-making forum;
- the Murray-Darling Basin Commission (MSBC), the executive and advisory arm of the Council; and
- the Community Advisory Committee (CAC), which provides the Council with advice and provides a two-way communication channel between the Council and the community.

The management of the Murray-Darling has also been affected by the 1994 Council of Australian Governments (CoAG) water reform package (Council of Australian Governments 1994) that brought together principles such as competitive neutrality, 'user pays' and ESD (Connell *et al.* 2006: 86). A result of the CoAG agreement has been to reinforce the policy preference for price-based and market-based solutions to environmental problems.

3.1 The Living Murray Initiative: First Step to Nowhere

The degraded environmental condition of the Murray-Darling continues to demand remedial actions. To this end, studies were undertaken throughout 2002 and 2003 to assess the extent of the damage and the potential policy options open to the MDBC. The key outcome of a 2002 Expert Reference Panel (Table 1) was that there would be a high likelihood of achieving a healthy Working River Murray System if provisions for 3350

GL of new environmental flow allocations were made. Anything less than 1630 GL would be unlikely to return the river to a 'healthy' status.

[Table 1 here]

The policy to follow up from these findings was the 'Living Murray Initiative', established by the MDB Council in 2002 with the aim to 'create a healthy working river that assures us of continued prosperity, clean water and a flourishing environment.' (Department of Environment and Heritage 2004) In light of the Expert Panel's recommendation, the Living Murray Initiative aims to reallocate 500GL per annum to the river from the expenditure of $500 million, commencing 2004-05[9]. In addition to the reallocation of 500GL, the Living Murray Initiative focuses on maximising environmental benefits for six significant ecological assets,[10] and meeting specific ecological objectives and outcomes for each of these assets (Murray-Darling Basin Ministerial Council 2003).

In 2004, CoAG reaffirmed the 'first step' of the Living Murray Initiative and signed the IGMDB.[11] As part of the IGMDB the States are required to establish targets for investment and water recovery to demonstrate their commitment to an early roll out of implementation. In addition, three year indicative targets are to be set for the amount of water to be recovered within each jurisdiction, recognising the differing opportunities within each, their relative share of water under the MDB long-term diversion caps

[9] Comprising the following funding contributions: Commonwealth Government $200 million, NSW $115 million, Victoria $115 million, South Australia $65 million, Australian Capital Territory $5 million.
[10] Barmah-Millewa Forest; Gunbower and Koondrook-Perricoota Forests; Hattah Lakes; Chowilla Floodplain (including Lindsay-Wallpolla); the Murray Mouth, Coorong and Lower Lakes; and the River Murray channel.
[11] IGMDB was a subordinate document to the National Water Initiative agreed to by COAG in June 2004.

established under the Murray-Darling Basin Agreement, and watering regime under the Basin Environmental Watering Plan. (Council of Australian Governments 2004). Victoria's contribution is 214GL, the NSW contribution is 249GL, the ACT commitment is 2GL while South Australia committed to 35GL (Murray Darling Basin Commission 2004: 6)

It is clear that the IGMDB and its associated agreement, the National Water Initiative, are the latest development in a long history of water reform in Australia that potentially offer significant improvements to the environmental health of Australia's water resources. However, to date, three years after the adoption of the Living Murray Initiative, only 11 billion litres have been returned to the Murray-Darling River system as a result of this policy.[12]

3.2 Australian Government 'Buy-Back' Scheme: The Turnbull Initiative

In April 2006, the lack of progress made by any of the parties to the IGMDB to reallocate water back to the environment prompted the Prime Minister John Howard to declare the need to 'put a bomb' under the process (Minchin 2006) The subsequent action was announced by Malcolm Turnbull, Parliamentary Secretary to the Prime Minister with special responsibility for Water Policy, on 28 April. In a statement printed in *The*

[12] While the reallocation of water back to the river has been slow to fruition, there has been some achievements made to-date: projects approved will deliver 240GL at a cost of $179m; 18 feasibility studies for possible recovery of additional water have been funded; active environmental management of existing water; implementation of the Living Murray communication strategy including a media tour of the icon sites in May 2006; approval of an Indigenous consultation project across the Living Murray program; construction of waterflow regulators; improvements to native fish habitat through resnagging within the Hume to Yarrawonga reach of the river and continued implementation of the fishway program at Lock 10; and mobile pumps to enable rapid response to Red Gum watering needs on the Chowilla Floodplain. (Murray Darling Basin Commission 2006)

Australian, Mr Turnbull revealed a proposal to purchase water entitlements back from farmers in the Living Murray:

> The Living Murray Initiative should invite tenders of water, provided that the water offered for sale for the environment is water that can be delivered no later than 2009, and, most importantly, is water that has become available by reason of water-efficiency measures (Turnbull 2006).

The proposal, which was accepted by the MDBC Ministerial Council on 19 May 2006, will mean that farmers will be able to use the tender as a means of financing water-efficiency infrastructure. Thus the water sold by farmers must be produced by efficiency measures such as converting channels to pipes to reduce evaporation.

While the Australian Government's proposal was endorsed at the May MDB Ministerial Council, the details have yet to be finalised. The Commonwealth Government's initial proposal was for a 90 day tender period and that 'there would be no limits on price or volumes of water to be offered' and, of course, the process is entirely voluntary. (Turnbull 2006) The total financial commitment — in addition to the $500 million already committed for the Living Murray Initiative from both the Commonwealth and States — includes an additional $500 million cash injection, although some of these funds will be diverted to speed up progress on the Basin Salinity Management Strategy, and the Environmental Works and Measures Programme.

The price paid to water users for their entitlements has important implications for the 500GL Living Murray target. In theory, the price paid for scarce water resources should reflect both the opportunity cost of alternative consumptive uses and the loss of 'in situ' benefits associated with any given water use. In other words, the price must reflect the

value of water ‘in situ’ in terms of the benefits it generates for aquatic life, maintaining ecosystems and aesthetics, together with the long-term benefits of a healthy river system (both for the environment and for consumptive uses). If the latter benefits are not reflected in the price of water, the price paid to farmers will be inflated because it will only reflect the opportunity cost of not using the water for agricultural production. This pricing principle is not in the Australian Government’s ‘buy-back’ scheme, and thus taxpayers will be paying too much to restore the Living Murray to a healthy status. That is to say, the $500 million will buy less water and deliver fewer environmental flows than if the price paid for water entitlements were to include its ‘in situ’ price.

Another pricing issue is the Australian Government requirement that water users tendering their water entitlements must do so to fund infrastructure that generates water savings. This constraint forces those who win the tenders to make investments in water efficiency as a condition of the purchase of their water entitlements. Improvements in water efficiency, all else equal, are desirable but they come at a cost. For example, although farmers attach a large value to their entire water entitlements, they may only attach a small value to marginal reductions in their entitlements. In such cases, it would be cheaper for the Government to purchase from such farmers water entitlements that are currently in use without imposing any infrastructure requirement and then direct this water for environmental flows. In the proposed tenders water users must be compensated for any infrastructure costs. In turn, this raises the price that must be paid by the Government and, thus, reduces the amount of water that can be returned for environmental flows given a fixed budget.

4. The Challenge of Water Pricing

The designing of markets for water is complicated by a number of factors. First, unlike markets for consumer products, water is a basic human need such that governments often try to ensure that it is available at reasonable levels to everyone.[13] Second, if there are externalities, or costs imposed on others from using water and these are not accounted for, then there will be a divergence between the economic and market or financial price of water for its use. Third, water scarcity is not just an issue of water availability or supply, but is closely linked to the nature of its demands. These demands are influenced by the *level of treatment* (households demand a year-round and safe supply of water that requires expensive treatment while irrigators demand water only at specific times of the year that requires no treatment), *reuse* (water in a river can be reused many times depending on its applications), and *jointness* (water in a dam can jointly supply demand for electricity, recreational demands and also household demands) (Griffin 2006).

The competitive allocation and price of water is also constrained by the myriad of jurisdictional provisions for water allocation. These rights may include extraction rights or delivery rights, and they may differ across jurisdictional boundaries yet refer to the same water body. This creates significant regulatory fragmentation across boundaries, which in turn poses difficulties for efficient water pricing and trading.

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[13] There are some economists who contend that water is just like any other private good, and that its production allocation should be determined by the overriding value of consumer's sovereignty i.e. by the amount that people are "ready, willing and able to pay" for it. Thus, in this argument, if the poor cannot pay as much for a unit of water as the rich they should get less water, even if the marginal value to them in terms of other values (or utility) is greater. See Perry, Rock and Seckler (1997).

4.1 Water Entitlements: the Right-of-Access to Water

In Australia, the Crown or the state has a statutory right to the use, flow and control of water. All other rights to water are conferred directly by legislation or granted in exercise of a statutory power by a government agency. As a result, a right to water — except in the case of the Crown — is a right-of-access to water.[14] While a right of access to water — either under the common law or under legislation — may provide the authority for the use of water for irrigation purposes, the use of water for irrigation is in some cases the subject of its own management and regulatory regime (Fisher 2006: 10271). Thus, water used for irrigation (such as in the Murray Darling Basin) may find its source in various ways. It may flood naturally over the surface of the land, or it may be directed by way of channels across the surface of the land or via some other means. In any event, the taking and use of water for irrigation requires *some form of authorization* that is granted in accordance with a set of strategies and plans.[15] It is the existing entitlements that farmers in the Murray-Darling possess that the Australian Government is tendering for, but at what price?

4.2 Water Pricing

To make comparisons between different types of water demand that involve consumptive use economists frequently use marginal net benefit (MNB) functions. These functions are

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[14] Please see Productivity Commission (2003) for further details on water rights in Australia and overseas.
[15] Fisher (2006) describes several different rules of law giving effect to the National Water Initiative. Water access entitlements frame access in terms of individual ownership – creating a fictitious interest in respect of a water resource. Water allocations define the volume of water allocated to a water access entitlement – defining the quantity of water represented by the share of the water resource during the period of time specified in the allocation. Finally water use approvals are instruments specify the purpose for which the water may be used.

the marginal private benefit (as represented by demand or MPB) of water, less the marginal private cost (MPC) of supplying this demand, i.e. MNB = MB – MPC. Economic efficiency requires that the marginal net benefits of water are equal across users if there is no reuse, and must also account for the marginal external cost (MEC) of water use — the value of water 'in situ'. If the marginal private cost is simply the private cost of supplying water and does not include the value of water 'in situ', such as for environmental flows, then the market equilibrium from water trading will not be economically efficient.

Given a zero 'in situ' value of water (MEC of water use is zero), and in the absence of flow or reuse by rival users of water (all water is entirely consumed in its given use), an efficient allocation of water across different and competing uses requires that the marginal net benefits be equalised.[16] This is illustrated in Figure 2 for the case of two water uses. An allocation to the left of w* (more to use 2 and less to use 1) would result in MNB1 > MNB2 which implies that consumers of water use 1 could potentially pay the consumers of water use 2 to use less water and both groups could potentially be better off. If the water allocation were to the right of w* (less to use 2 and more to use 1) then consumers of water use 2 could potentially pay the consumers of water use 1 to use less water and both groups could potentially be better off.

Water trading in the Murray-Darling basin is much more complicated than the ideal shown in Figure 2 because there are a myriad of users, not all uses are rivalrous, there exist various restrictions on trades and not all rights are equivalent in terms of their

[16] In the case of water reuse or return flow to the river an efficient allocation will account for the amount of water returned that is available for other users. All else equal, the more water is returned by a user, the greater will be its consumption if water is allocated efficiently

security of access to water. As a result water trading along the Murray River does not equalise the MNB of different uses. Nevertheless, Figure 2 is a useful benchmark because it shows that the market price of water should be determined by the interaction or valuations of the marginal net benefits among water users in the absence of any non-market values.

[Figure 2 here]

In addition to considering an efficient water allocation in terms of consumptive water use, we must also consider the value of water 'in situ', or the benefits it generates in terms of environmental flows and services (maintaining aquatic life, aesthetics, etc.) separate from its value in consumption. This idealised case is illustrated in Figure 3 assuming that all water users incur a withdrawal charge equal to the marginal external cost of using water rather keeping it 'in situ'. In this case, the marginal private costs of supplying water for the two uses is increased by the amount of the withdrawal charge which shifts inwards their respective MNB curves relative to the case shown in Figure 2. Provided that each user faces the same per unit withdrawal charge (and hence imposes the same marginal external cost from water use) the water allocation will be identical to what it was previously *if and only if* the new MNB (including the withdrawal charge) of each user is equal to or greater than the MEC. This is the case shown in Figure 3 where the water allocation of W* is unchanged but the market price for water falls from p0 to p*.

[Figure 3 here]

If the marginal external cost of water uses differs between water uses, the imposition of a withdrawal charge equal to the respective MECs of each use will change the original water allocation. In this case, more water will be allocated to uses that impose relatively

smaller costs on the environment relative to uses that impose high marginal external costs, all else equal. If the MNB with the withdrawal charge at its previous withdrawal rate were to be negative, the value of water in use would be less than its value 'in situ'. In such a case, the water use that occurred without a withdrawal charge would change as the previous withdrawal rate would no longer be profitable after the imposition of the charge, thereby, diminishing the water used for that purpose.

Figure 3 shows that even if the water use is unchanged, the price of water will fall by an amount equal to the withdrawal charge, or the MEC imposed on society from water use. The point is that until, and unless, water users pay the marginal external cost that they impose on others from water extractions the market price they pay for any given amount water used will be too high. Given that there is currently no 'in situ' price for water then the price offered to users in the Australian Government's buy-back scheme must, necessarily, be inflated and will not be a cost effective method of increasing environmental flows to the Murray River.[17]

4.3 Water-efficiency Tenders

A key strategy of the Turnbull initiative announced in April 2006 is to only pay for water that arises from measures that promote water savings. At first sight, this appears to be a desirable goal — use Government funds to increase environmental flows simultaneously with improvements in water efficiency. The problem is that investments that generate water savings are not costless such that every dollar that users spend in such schemes will

[17] A failure to include the 'in situ' price of water is also inconsistent with National Water Initiative that states in Clause 65 (ii) that there should be "full cost recovery for water services…, including recovery of environmental externalities, where feasible and practical;".

have to be compensated by the Australian Government in its reverse tenders. In other words, the government requirement that water users undertake projects to generate water savings increases the cost of purchasing water by the amount of the cost of these investments. The point is that instead of spending money to encourage water users to build infrastructure to make water savings it would be cheaper to simply purchase and then retire active water entitlements. The end result of the current policy is a lower litre-returned-to-dollar-spent ratio and less environmental water flows.

4.4 Policy Implications

A failure to price water 'in situ' and the imposition of a requirement that water users undertake infrastructure projects to generate water savings will increase the cost of purchasing water entitlements and, thereby, reduce the amount of water generated for environmental flows in the Murray River for the allocated budget. Despite CoAG advocating that water prices cover the costs associated with externalities this has not yet been implemented in Australia except indirectly via water infrastructure service provision charges that are used to pay for actions to prevent environmental damage.[18] As a result the latest Australian Government initiative is not cost effective — a *sine qua non* of good economic policy. The principal beneficiaries of the current policy are current holders of water entitlements who can generate large water savings per dollar invested in water savings infrastructure. The principal losers are Australian taxpayers who value highly environmental flows in the Murray River.

[18] See Productivity Commission (2003) for further details. South Australia and the ACT also impose environmental management charges on the water consumed to fund management operations and catchment activities.

A concern for water users of government purchases and retirement of active water entitlements is that it may increase the market price for water. This, presumably, is the justification for the water savings requirement in government purchases of water entitlements as the amount diverted to flows should, in theory, equal the amount of water no longer needed in its previous use. In reality, any intervention in the water market will affect the water price, and not necessarily in the way anticipated. For instance, imposing an extraction charge from the Murray River to proxy its value 'in situ' will reduce the market price of entitlements while the Australian Government purchases of water entitlements will tend to raise the market price.[19] The net effect on the market price from purchasing entitlements is, however, ambiguous and would depend on the size of the extraction charge, the amount of water purchased by government, the elasticities of supply and demand for water, water trading restrictions, and other factors.

The key policy insight is that current Australian Government policy is inconsistent with the stated aims of the Living Murray. Namely, for the same amount of expenditure much more water could be returned for environmental flows if water users faced a net extraction charge for the 'in situ' price of water and they were not forced to undertake water efficiency measures to sell their entitlements to the Australian Government. The unstated agenda is that returning water to the Murray River is desirable, but not at the expense of increasing the price of water entitlements. If, as the Prime Minister states, he wishes to 'put a bomb' under the process to increase environmental flows then the Australian Government should seriously consider imposing a water extraction charge on

[19] See Dwyer *et al.* 2006 for details about how a volumetric charge on water use by irrigators might be implemented.

water users, and directly purchasing water entitlements without imposing a requirement that users undertake water savings via infrastructure improvements. To do otherwise, is simply to protect the interests of particular holders of water entitlements at the cost of the Australian taxpayer and the national environment.

5. Concluding Remarks

Australia faces important water challenges in balancing current water uses against the need to maintain environmental flows for non-market values. Perhaps the greatest of all water dilemmas exists in the Murray-Darling basin where the state of the river system is in decline, but users demand ever more water.

To improve the health of the Murray River, Australian governments have agreed to address the water use versus environmental flows question by investing hundreds of millions of dollars to return 500 billion litres of water to the river by 2009. In the most recent initiative, the Australian Government has pledged a further $500 million cash injection to purchase water entitlements that arise from water savings measures, and to accelerate progress on salinity management and environmental works.

The current policy, although helpful, suffers from two flaws: one, users do not currently pay a price for water that reflects the value of keeping water in non-use and, two, any purchases of water for environmental flows are conditional on users undertaking water savings measures. As a result of these failings the Australian Government will end up paying a higher price for water than it needs to, or required for economic efficiency. If returning water to the Murray River is a national priority, as stated by Prime Minister Howard, and if 900 billion litres is the minimum required to return the river to a healthy

working status, the Australian Government current policy should be changed to ensure the greatest possible amount of water is returned as environmental flows per dollar of expenditure.

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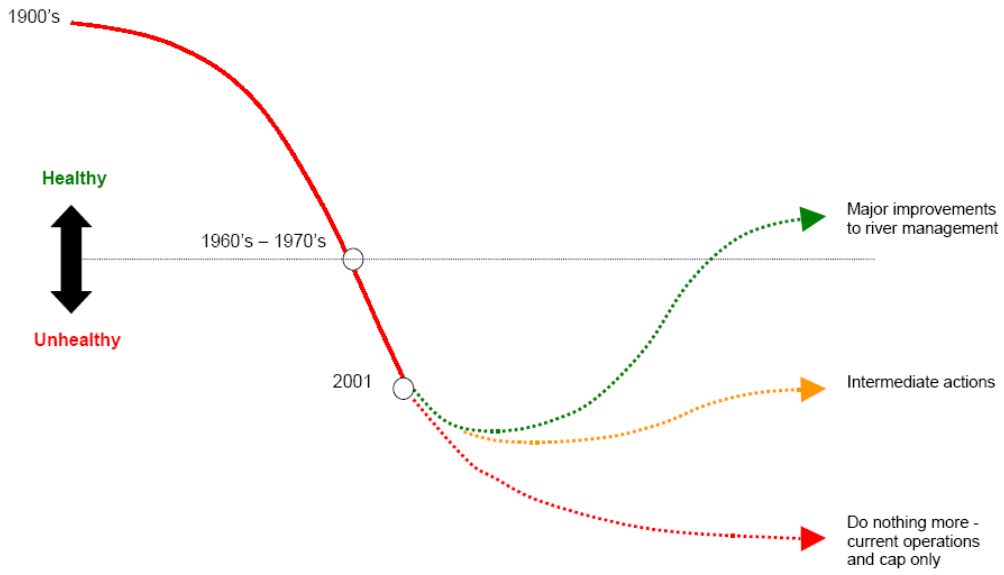
Figure 1: Evolution of ecological condition of Murray River system, with current and possible future conditions indicated



Source: (Jones *et al.* 2002)

Figure 2: Efficient Water Allocation between Water Uses Where 'In Situ' Value of Water is Zero

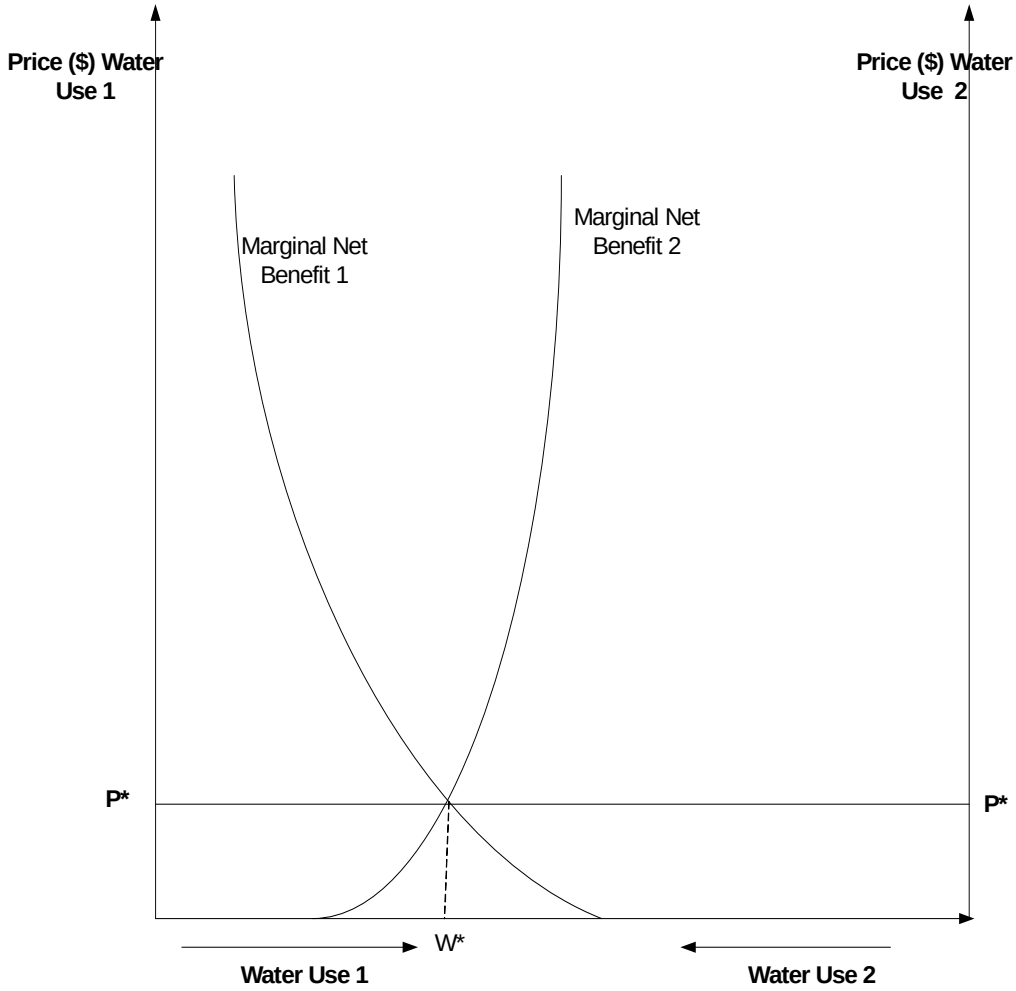


Figure 3: Efficient Water Allocation between Water Uses Where 'In Situ' Value of Water is > 0

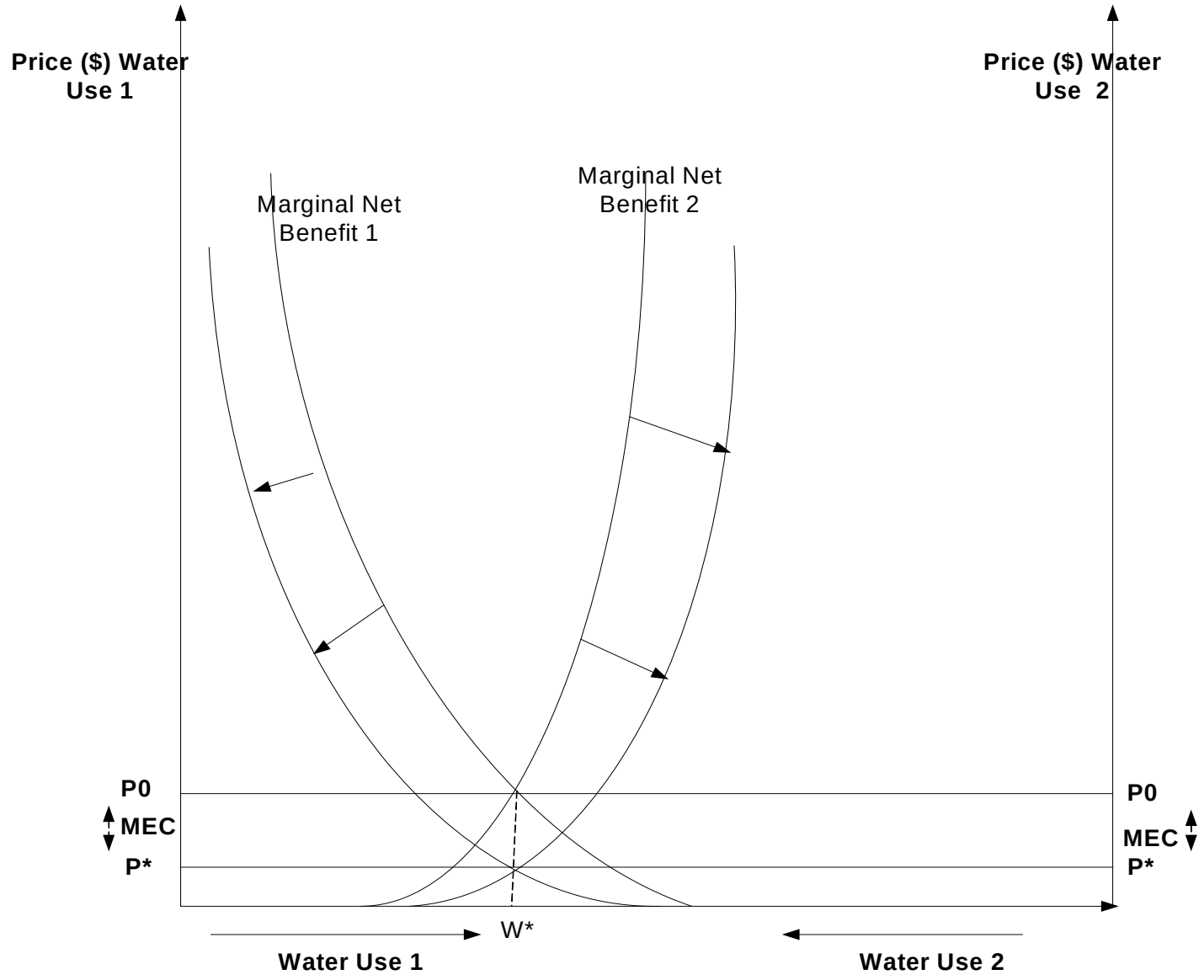


Table 1: Final summary of assessment of flow option packages and the probability of success of each management option for the Murray River.

Management Options	Probability of having a healthy working River Murray System
Do nothing more (current operations)	LOW
A. Improved operations	LOW
B. Improved operations plus 350GL new environmental flows p.a. (Murray source)	LOW
C. Improved operations plus 900GL new environmental flows p.a. (Basin-wide source)	LOW-MODERATE
D. Improved operations plus 1,630GL new environmental flows p.a. (Basin-wide source)	MODERATE
E. Improved operations plus 3350GL new environmental flows p.a. (Basin-wide source)	HIGH

Source: (Jones *et al.* 2002)