21 January 2009

Ken Matthews AO
Chair and Chief Executive Officer
National Water Commission
95 Northbourne Avenue
Canberra
ACT 2601

Dear Mr Matthews

Re: Submission to Biennial Assessment

Thank you for the opportunity to make a submission to the Assessment of Progress in the Implementation of the National Water Initiative (NWI). We have chosen to restrict our submission to those areas with which we have greatest familiarity and accordingly do not address all areas raised in the discussion paper.

We have included as part of the submission 2 recent papers. The first relates to the conceptual limitations of 'water use efficiency' as a policy goal in its own right. A version of this paper is scheduled for publication in *Agenda* shortly. This paper should be read in the context of sections 8 and 9 of the discussion paper. The opinions expressed in this paper can be summarised as follows:

- The notion of water use efficiency is spuriously applied and ill defined
- When viewed at a system level, water use efficiency projects primarily re-allocate water between claimants, especially if the resource is fully allocated
- The result is that water use efficiency usually deprives the weakest claimant
- The justification for public funding of water use efficiency projects is very weak and should be of major concern for policy makers

Although not dealt with in this paper we also have serious reservations about the on-going liabilities of water use efficiency projects. It would appear that the public investments in communal irrigation infrastructure cannot be included as part of the price determinations undertaken by economic regulators. The consequence of these arrangements could be that insufficient revenue is collected from water users to cover the replacement of those assets. Moreover, our understanding is that much of this infrastructure – like flume gates - has a considerably shorter life span than more rudimentary technologies. This may well result in additional calls on the public purse in the short and medium term to replace irrigation assets (yet again). In our view the NWC should make efforts to clarify this issue.

The second paper deals with the status of buyback programs and the serious problems arising from poor specification of environmental outcomes. This paper is presently being refined for publication purposes, but nonetheless points to major concerns about components of the policy framework. The

paper should be considered in the context of items 4 and 9 raised in the discussion paper. In sum, the attached paper highlights the following:

- Buyback has been transformed to a more active status at the political level at least
- There are major concerns about the manner in which alternative 'parcels' of water are being assessed
- There is a strong possibility that much public money will be expended purchasing low value water products that fail to match environmental needs
- There is also a desperate need to avoid over-simplification such that the only environmental metric is a 'volume' of water
- There is considerable scope for designing better buyback instruments that deal with information asymmetries. The work of Pincus and Shapiro (2008) also offers promise and should also be considered by the Commission.

Thank you again for the opportunity to make a submission to the Biennial Assessment. We look forward to reading the outcomes.

Regards

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The Paradox of National Water Savings: A Critique of 'Water for the Future'

Lin Crase and Sue O'Keefe

Abstract

The Commonwealth's assumption of greater control over water policy has been justified on the grounds that a 'national approach' to the problems in the Murray-Darling Basin is required to resolve the ills of the Basin. This paper investigates the validity of this contention in the context of the Federal government's 'Water for the Future' manifesto. The paper argues that the current naïve understanding of 'water use efficiency' concepts is likely to stymie any purported basin-wide gains from a 'national approach' to water policy.

Key words: Water Policy, Water Use Efficiency, Irrigation Efficiency, Federalism

JEL Codes: Q25, Q56

1.0 Introduction

The Howard government's *National Water Plan for Water Security* culminated in the Commonwealth Water Act in 2007[1]. A key component of this approach is a focus on the formulation of water resource policy at the national level, or at least at the whole-of-basin level in the context of the Murray-Darling Basin. The justification for this approach is that a national body is best able to assess and deal with basin-wide problems and overcome the dilemmas arising from competition between differing state jurisdictions.

Consequently, the Water Act (2007) legislates for the establishment of the Murray-Darling Basin Authority which, amongst its other obligations, has responsibility for "ensur[ing] that Basin water resources are managed in an integrated and sustainable way" (Department of Environment, Heritage, Water and the Arts 2008). Gaining universal agreement for the Murray-Darling Basin Authority at the Council of Australian Governments (CoAG) meeting in July 2008 was proclaimed as one of the most significant accomplishments of CoAG.

The rationale for superordinate management of water resources in an interconnected basin resonates with many in the electorate. The extant degradation of the Murray-Darling Basin's riverine environment has been

[1] In April 2008 the newly elected Federal Labor government signalled its intentions to continue, in the essentials, the Howard governments' approach to Australia's water resources.

used to illustrate the urgent need for national intervention. For example, in the context of over-allocated water resources the Federal Minister for Climate Change and the Environment observed that "like many areas of public policy involving multiple levels of government, water policy has been derailed by bickering and blame" (Wong 2008a, p. 2). Similarly, the Minister argued that Commonwealth action was required to ensure that the nation as a whole "make[s] better use of our available water resources" (Wong 2008a, p. 3). Hopefully, and perhaps naïvely, the Minister also contends that "this means improved efficiency and productivity of water use, and better use of water markets to optimise the economic benefits that water brings" (Wong 2008a, p. 3).

Notwithstanding the political appeal of national control of water resources in connected systems such as the Murray-Darling Basin and the mileage from proclaiming the benefits of water-use efficiency, the most recent episode of national intervention does not augur particularly well. A superficial understanding of core concepts such as 'irrigation efficiency' and the pervasive influence this can have over the allocation of funding provide grounds for questioning the efficacy of the national control of water resources. Put simply, the benefits of a system-wide approach to decision making are quickly eroded when the criteria upon which decisions are predicated are themselves seriously flawed.

Of particular concern in this context is the resolution by the Federal government to co-sponsor the modernisation of irrigation in Victoria to the tune of $1 Billion. We contend that this stands to significantly reduce the quantum and reliability of water supplied to those who extract water downstream of the Goulburn Valley and also seems likely to weaken existing environmental claims in the River Murray. The assertion by some that national decision making is a sufficient condition for achieving improved environmental outcomes in the Murray-Darling (see, for instance, ABC On-Line 2007) is thus both overly-optimistic and unhelpful.

The circumstances that have led to these events are traced in this paper. We argue that downstream users will be significant losers as a result of upstream 'renovation' of irrigation. We also aim to shed light on the flawed use of concepts such as 'water use efficiency' particularly when it is portrayed as an environmental saviour and thus deserving of support from the public purse.

The paper itself comprises four additional parts. In Section two we briefly outline the political and policy background that gave rise to the decision by the Federal government to play a greater part in water policy. This is followed, in Section three, by a review of the various concepts of water-related efficiency. Importantly, this section illustrates the critical issue of scale when measuring and accounting for water use. The *Food Bowl Modernisation Project* (FMP) in northern Victoria and the Federal government's decision to support this project with a $1 Billion injection from its own coffers are reviewed in Section four. The final section comprises some brief concluding remarks.

2.0 The Policy Context for Federal Intervention in Water Management in the Murray-Darling Basin

Australia's water resources were unequivocally vested in the states when the constitutional reformists chose to reject the doctrine of riparianism[2] in the late nineteenth century (Musgrave 2008, p. 35). This was ratified in the constitution itself by the inclusion of Section 100 which sought to constrain interference by the Commonwealth and limit national powers to "abridge the rights of the State or of the residents therein to the reasonable use of waters of rivers from conservation or irrigation". Given such a strong stance against Commonwealth intervention, this meant that agreement was required between those states that shared the water resources in the Murray-Darling Basin. Accord originally took the form of the River Murray Agreement of 1914 which has subsequently evolved into the Murray-Darling Basin Agreement. These arrangements leave Basin water management in the hands of representatives of each of the signatory states plus an agent of the Commonwealth. Notwithstanding that the Commonwealth intermittently played an influential role in several earlier water policy decisions, such as the Snowy Mountains development, the Commonwealth's authority over water resources in the Murray-Darling remained largely in line with the intentions of the constitution until the mid-1990s.

Commencing with the CoAG Agreement on Water Resource Policy in February 1994 and the related Competition Principles Agreement of 1995, the Federal government has progressively sought to increase its influence over the water policy agenda. For the first decade or so, this was accomplished primarily through the suasive influence of the Federal purse. The early CoAG reforms and the National Water Initiative (NWI) of 2004 were all premised on state jurisdictions complying with a national framework in order to be eligible for tranche payments from the Federal government. As an illustration of the rise of national and collective decision making, almost half of the projects embodied in the 2004 NWI required national action or a heavily coordinated response from state jurisdictions (McKay 2008, p. 55). However, the primary mechanism for achieving this cooperation was the $2 Billion to be allocated by the National Water Commission as part of the Australian Water Fund.

These arrangements changed markedly in 2007 when the then Prime Minister announced his intentions to legislate a *National Plan for Water Security*. At the time the Prime Minister expressed exasperation about the slow progress on reform and proclaimed that "the tyranny of incrementalism and the lowest common denominator must end" (Howard 2007, p. 1). Similarly, Prime Minister Howard decreed that national intervention was required to solve the problems of the Murray-Darling Basin and argued that "as long as integrated water systems are being managed piecemeal by governments with competing interests, the execution of even the best national agreements will remain challenging and contentious" (Howard 2007, p. 1). National decision making was espoused as the solution to water management in the Basin.

[2] Riparianism effectively allows landowners to exploit water that attends or adjoins their property on the proviso that such use does not unreasonably interfere with the existing rights of other landholders.

To give effect to the *National Plan for Water Security* Prime Minister Howard sought the referral of state powers from Basin jurisdictions. In return the Commonwealth committed about $10 Billion over 10 years to address environmental degradation and over-allocation. The largest portion of the funding ($6 Billion) was to be allocated towards engineering solutions to enhance the 'efficiency' of irrigated agriculture. This 'modernisation' of irrigation was claimed to deliver 'water savings' which could then be used to underpin environmental sustainability.

The *National Plan for Water Security* was both hurriedly prepared and ambitious. Given the government's standing in the electorate at that time, the formulation of the *National Plan* was arguably more an act of political desperation than it was a response to concerns about deficiencies in water resource management. As Watson (2007) noted, the authors of *The Plan* were "not claiming spurious accuracy for their major proposals. As subsequently emerged, the ten-point *Plan* to spend $10 billion over ten years was prepared in haste, well away from the troublesome gaze of Treasury and Finance officials and the experienced eye of the Murray-Darling Basin Commission" (p. 1).

Regardless of the financial inducements on offer, the Victorian government refused to sign up to the *National Plan for Water Security* and the then Federal government proposed the Water Bill 2007 without the complete referral of powers it had sought. The Explanatory Memorandum that accompanied the Bill argued that Commonwealth control and decision making would "enable water resources in the Murray-Darling Basin to be managed in the national interest, optimising environmental, economic and social outcomes" (p. 2). The Memorandum simultaneously signalled that this would be accomplished by four main funding targets: namely, "modernising Australia's irrigation infrastructure; addressing overallocation in the Murray-Darling Basin; reforming management of the Murray-Darling Basin; and new investments in water information" (p. 2).

The Howard government was defeated and the Federal Labor government took power in November 2007. In April 2008 the Minister for Climate Change and Water released a broad outline of the new government's water policy in the form of *Water for the Future*. This document generally mirrors the former government's approach insomuch as non-trivial public funds have been earmarked for the purpose of 'modernising irrigation' whilst a lesser but significant emphasis has been placed on restoring balance by buying back water access rights. In the context of 'modernising irrigation', the federal government specifically undertook to sponsor the renovation of irrigation infrastructure in Victoria to the tune of about $1 Billion, bringing the total commitment from State and Commonwealth governments to $2 Billion. Some commentators have viewed the generosity of the Federal government as a reward to the Victorian government for its resistance to earlier calls by the Howard government's request for referral of powers (see, for example, Milne 2008).

Federal support for 'modernising' Victoria's irrigation was subsequently ratified at the CoAG meeting in July 2008 when a further $103 Million was committed to assist with upgrading irrigation infrastructure in the north west of the state under the guise of the 'Sunraysia Modernisation Project'. New South Wales was also offered $1.358 Billion mostly for 'water saving' initiatives in irrigation, some of which were described as being "at the conceptual planning stage" (CoAG 2008b). A total of $610 Million was offered to South Australia, mostly for projects that purportedly "upgrade irrigation infrastructure", whilst Queensland is expected to receive $510 Million for water projects. In the case of Queensland, $350 Million is set aside for purchasing water entitlements from willing sellers but most of the remaining funding is to assist with the "roll-out [of] community level irrigation planning and infrastructure investment" (CoAG 2008b). By the completion of the CoAG meeting in July, the Federal government had committed about $4.3 Billion to projects across the Basin, the majority focussing on water infrastructure projects. The espoused view of CoAG was that "[t]hese measures will reduce water loss and return water to the environment to help restore the sustainability of the resource and enable a long-term future for the communities of the Basin" (CoAG 2008b).

An important caveat was added to most of these funding initiatives, namely that projects would be "subject to due diligence" (CoAG 2008b). Regrettably, this is not defined with precision but presumably it is likely to be politically difficult to reverse such commitments should the projects actually prove deficient.

Setting aside the financial and political dimensions to these decisions for the moment, there must now be serious concerns about the capacity of a national water Ministry to deliver efficacious outcomes at a basin-wide scale. Of particular concern is the continuing naïve support for the view that 'modernising irrigation' or investing in 'water use efficiency' can generate substantial and fungible 'water savings' at a basin level. A brief review of these critical concepts is presented in the following section.

3.0 Efficiency and Water

In the context of irrigation, the common perception is that increasing efficiency in agriculture can provide a solution to the water crisis and result in 'wins' for all players (Molle and Turral 2004; Seckler, Molden *et al.* 2003). In contrast to the economist's conceptualisation of efficiency, irrigation efficiency is primarily an engineering concept concerned with the volume of water diverted and consumed (Cai, Ringler *et al.* 2001). Engineering interventions in an attempt to 'save' water or to 'reduce losses' from an irrigation system are frequently said to improve 'water use efficiency'. However, substantial confusion surrounds these concepts, despite the fact that they are often used interchangeably. Perry (2007) argues that this confusion has frequently resulted in not only ineffective, but also undesirable, outcomes from technical interventions to 'improve' irrigation efficiency (p. 373).

Perry (2007) traces the development and use of various conceptualisations of efficiency back to the original contribution by Israelson (1950) that came to be known as classical irrigation efficiency. Israelson (1950) defined irrigation efficiency as the ratio of the water consumed by crops of a farm or system to the water diverted (Perry p. 371). Despite later elaboration and development[3] , Israelson's (1950) original definition, based ostensibly on the relationship between water used by the crop and the water diverted, remained the underlying basis for water accounting.

Importantly, the classical concept of efficiency ignored the potential for return flows and recycling. Later contributions to the debate emphasised the use of ratios or fractions to describe water use and to explicitly consider the impact of return flows (See for example, Jensen, 1993; Willardson 1994; Allen et al 1996 1997). According to these definitions, water diverted for irrigation could be divided into the consumed fraction, comprising beneficial consumption (intended purposes including environmental) and non-beneficial consumption (e.g. weeds). The remainder was classified as the non-consumed fraction and this comprised two groups - recoverable flows and non-recoverable flows (Perry 2007, p. 372).

This approach highlights the fact that not all water purportedly 'lost' from a particular irrigation district in fact constitutes a loss to the hydrological system as a whole. For instance, take the case where an irrigation district in Victoria presently generates non-consumed flows that are then 'recovered' in the form of an environmental use in the River Murray or via extraction by a downstream or groundwater irrigator in another state. If actions are taken to reduce the non-consumed fraction in the irrigation district, the net impact of these activities must take into account the redistribution of water away from existing users (say the environmental use or the downstream irrigator). If the intent is to 'save' water, it is vital to know whether the 'losses' from the irrigation system are in fact losses at all. After all, when water is 'lost' from an irrigation district in Victoria it does not go to Mars. Similarly, in an international context, Sakthivadivel and Chawla (2002) expose the flawed reasoning that redirecting seepage losses to cities was seen as the best way to increase supply without impacting existing uses, but the 'losses' were found to be already tapped by other users.

The issue of scale of analysis assumes particular importance in this context and further developments in water accounting conceptualised the idea of water balance at the basin level (Molden and Sakthivadivel 1999; Perry 1999; Seckler, Molden *et al.* 2003). In an Australian context, Gyles (2003) demonstrates the 'illusory' nature of water savings and argues that this

[3] Definitional refinements included attention to the concepts of consumptive beneficial use which comprises the quantity of water effectively used to control soil salinity (Jensen 1967) and distribution and application efficiency (Bos and Nugteren 1974; Bos and Nugteren 1982). Distribution efficiency is the ratio of the volume of water delivered to the fields to the volume delivered to the distribution system. Application efficiency is the ratio of the volume of water needed (and made available) to meet the evapotranspiration needs of crops compared to the volume of water delivered to the fields.

derives from "...errors in logic and the inability or reluctance of the promoters to view water flows in a systems context" (p. 13). Notwithstanding these developments, 'improvements' in irrigation efficiency continue to be calculated at farm or irrigation system level without regard for the overall impact on basin balances.

The importance of scale

At the global level in the long term, evaporation from water bodies and evapotranspiration from land and vegetation must equal precipitation. However, as soon as the frame of reference is spatially or temporally narrowed, flows across borders become of vital concern (Perry 2007). Similarly, Perry (2007) notes that only where river flows are sufficient to meet demands, can irrigation efficiency be examined in isolation (as is done in classical efficiency). Thus, given the intensified sectoral competition under conditions of severely limited supply, it becomes increasingly important to conceptualise water use at the basin level. From this perspective, distinctions must be made between consumptive uses which remove water from the current hydrological cycle and non-consumptive uses which return the water for potential reuse. Moreover, "[c]hanging scale draws us from a mere question of cost-effectiveness of water–saving technology into a wider and thornier question of water allocation, rights to extract water and regulation of its use" (Molle and Turral 2004 p. 10).

Adopting a 'basin-wide' perspective invokes the 'water efficiency paradox' since when water is used, a substantial part of it is not 'used up' but is retained within the hydrological system (Seckler, Molden *et al.* 2003). It is therefore possible for each component part of a water system to exhibit low water use efficiency but when viewed from the perspective of the system as a whole, it may be quite efficient. This paradox means that there are many instances of purported water 'savings' that when analysed further amount to no more than a redistribution. For example, Molden and Sakthdivadivel (1999) illustrate the importance of the scale of analysis in estimations of classical efficiency, citing the example of Egyptian irrigation which is approximately twice as efficient when measured at a basin level compared to the field level. In simple terms, this arises because water that is 'lost' or 'leaks' from upstream users is frequently recaptured by downstream users.

Seckler, Molden and Sakthdivadivel (2003) argue that the potential to 'save' water is overestimated as the application of a majority of the concepts of water use efficiency "…systematically underestimate the extent of existing efficiency by a very large amount" (p.37). Viewed from this perspective, gains to be made have been much overestimated and purported savings merely result in some users being able to increase their usage whilst others downstream face reduced availability. Thus, these interventions result in spatial shifts or reallocation of water rather than 'savings' (Molle and Turral). The implication is that local interventions to 'save' water are likely to alter the flow regime and impact on other users. In the case of closed basins (defined by Molle and Turral (2004) as those with a relatively small amount of

uncommitted run-off leaving the basin) with major constraints of water scarcity, gains in local efficiency eventually amount to reallocation. Clearly, the modest flows making their way to the mouth of the Murray and the much-publicised excessive demands for water in the Basin places the Murray-Darling in this category.

The literature contains a number of examples that highlight the fallacy of water savings on a basin level (see, for example Perry 2007; 2008). Molle and Miranzadeh's 2004 case study in Central Iran highlights the interconnectedness of water users in a closed basin. They conclude that micro level conservation through canal lining, did not eventuate in the expected water 'savings' but "…only lead to having more water spread and depleted locally to the detriment of users downstream" (p. 3). Until policy makers understand that all water that 'leaks' from a channel does not automatically constitute a loss to the system as a whole then similar policy disappointments will occur in Australia**.** Estimates of the quantum of water to be realised by a particular 'water saving initiative' are all-too-often exaggerated because the only water that can really be saved is that portion that enters a saline sink or evaporates and that which is consumed in non-beneficial consumption. Even in the case of the latter (say irrigation water consumed by weeds instead of crops) this water is seldom made available for other users since farmers invariably use the 'saved' water to expand production on site.

Molle and Turral (2004) refer to the supposed 1998 'win-win' agreement between Southern California Metropolitan Water Authority and the Imperial Irrigation district. This agreement included the lining of canals and the transfer of usufructuary rights to Los Angeles equivalent to the amount 'saved' through this measure. The actual impact of this project, viewed from a basin-wide perspective, was the deterioration in the quality of the recharge to aquifers tapped by farmers on the other side of the border in Mexico (p.4). While the impetus for this type of agreement may be understandable in the context of competing national jurisdictions, it is difficult to discern its logic in an Australian setting.

In short, the purported 'savings' that emanate from improved storage or conservation at one point in a basin necessarily diminishes that available further downstream (Molle and Turral 2004). Moreover, any analysis of water use efficiency must take account of the particular context (location of diversions etc) lest the analysis become 'worse than meaningless [causing] wrong decisions to be made economically, hydrologically and ecologically' (Perry 2007 p. 369).

4.0 Food Bowl Modernisation and an Integrated National Approach?

On the basis of the preceding discussion it would appear that there is some merit in taking a national approach when water resources are shared across competing jurisdictions. For example, without a national approach, a full appreciation of the downstream impacts of investments in 'water use efficiency' in one upstream jurisdiction may not emerge. Regrettably, there is no evidence that this broader, integrated view has arisen from national intervention in Australian water policy. To illustrate this problem we use this section to describe and analyse the *Food Bowl Modernistaion Project* (FBMP) which recently won the support of the Commonwealth government. Similar arguments may well apply to other projects of this genre although the absence of data on many, particularly those that are "currently at the conceptual planning stage" (CoAG 2008b) makes scrutiny problematic.

The euphemistically named FBMP forms only one component of the Victorian Government's ambitious water policies assembled under the *Our Water Our Future* framework in 2007. This framework also comprises the construction of a 150 GL desalination plant in the Wonthaggi region, expansion of the Victorian water grid by establishing additional pipelines between major centres, increased capital expenditure on water recycling projects and additional support for water recycling programs.

The FBMP has six key elements.

First, manual structures for managing the supply of water via channels are to be replaced with automatic channel control technologies.

Second, some sections of the open channel network are to be replaced with pipes and/or remodelled.

Third, Dethridge wheels that measure water use are to be replaced with more accurate metering devices[4].

Fourth, changes to water charging to reflect the additional investment base are foreshadowed[5].

Fifth, some farm system adjustments, such as a reduction in the number of off-takes[6], are anticipated as part of the project.

And sixthly, a sequence of consultations and communication to adjust to different service demands are predicted (DSE 2008).

The FBMP reportedly aims to 'save' 225 GL of water per year by improving distribution efficiency with the resulting 'savings' to be shared equally – one

[4] It is a moot point whether replacing devices that inaccurately measure water will actually reduce water use.
[5] It is not at all clear to the authors how the G-MW charges will be adjusted to account for infrastructure that is substantially gifted to irrigators by other taxpayers.
[6] Each farm might have several points at which it draws water from the irrigation network. These are referred to as off-takes.

third being allocated to irrigators, one third being exported to Melbourne via the Sugarloaf pipeline and another third assigned to environmental uses[7].

In total, the *Our Water Our Future* initiatives are estimated to cost $4.9 billion, with 90 per cent of the cost being borne by water consumers via increased charges (Victorian Auditor-General 2008, p.19). Like the Howard government's *National Plan*, the Victorian initiatives were hurriedly assembled over a six-month period, largely in response to the unprecedented low inflows in 2006. Whilst the Victorian Auditor-General concedes that "the speed of the response" may account for some of the deficiencies in planning, he nevertheless observed that "for some of the key projects the rigour was inadequate" (2008, p. v). In the case of the FBMP the Auditor General specifically noted that "the upgrade costs (reported in the plan) represent the lowest level of rigour and were, at the time, based on a preliminary study by a stakeholder group (the Food Bowl Alliance)" (Victorian Auditor-General 2008, p. 31). Importantly in the context of 'water savings', the Auditor-General also sourced earlier work used to develop the business case for the FBMP and found that in these earlier documents "the estimated water losses were more refined and **lower** than those published in the food bowl steering committee's final report in November 2007" (original emphasis, Victorian Auditor-General 2008, p. 35).

In order to shed additional light on the magnitude of this problem it is worth considering some of the earlier work undertaken on water use efficiency in this setting. Of particular interest is a pre-feasibility assessment undertaken by Marsden Jacob on behalf of the Murray-Darling Basin Commission in 2006. This work was undertaken primarily to assess the quantum of water that might be 'recovered' from the Shepparton Irrigation Area (SIA). The project had three main goals: to reduce irrigation outfalls through channel automation; to improve the detection of loses in the channel system, and; to undertake investments in seepage and leakage reduction. The SIA is only one of six districts covered by the FBMP but the empirical approach and findings are instructive on several grounds.

To estimate the quantum of water that might be 'saved' by this project Marsden Jacob and Associates (2006) categorise the various forms of distribution losses within the irrigation network. In the context of the proposed automated channel technologies that forms a core part of the FBMP, the greatest potential for 'savings' is attributed to the water 'lost' through channel outfalls. A channel outfall is the mechanism by which excess water and return flows pass from the irrigation network to the surrounds. In some instances, this will be a structure that links to a river or in other cases water might pass

[7] A gigalitre is the equivalent of a billion litres of water but the metrics of water frequently prove vexing for the uninitiated. Politicians often resort to 'Olympic swimming pools' or 'Sydney Harbour' as the metric for the convenience of voters. In the interests of providing a more meaningful comparison we offer the following: a household tap left running full for an hour will usually use 1000 litres of water (i.e. a kilolitre or 1 cubic metre); the Victorian government is supporting a program to reduce Melburnians water consumption to 155 litres per person per day or about 226 kilolitres for an average 4 person household per year; in 2007 Melbourne's annual water consumption was about 370 Gigalitres.

to a swamp, creek or depression[8]. Marsden Jacob and Associates (2006) concede that "[t]he destination or final use of this return flow is unknown but could conceivably include extractions by diverters in the Goulburn and Broken system or discharge into the River Murray where it becomes part of the tributary contribution to Victoria's share of the River Murray water resource" (p. ESiii). Notwithstanding this caveat and numerous instances where data were unavailable or embodied significant measurement error (see, for instance Marsden Jacob and Associates 2006, p. 16; p. 21) the study arbitrarily assumed that differing percentages of the water that entered outfall drains constituted return flows. These range from an assumed 10 per cent return flow for four large drains to 100 per cent return flow where the outfall was directly to a river. An accompanying assumption was that 50 per cent of all outfalls came about as a result of rainfall rejection flows. These flows arise when irrigators close their receiving infrastructure because of heavy rainfall during an irrigation event. Put differently, this study assumed that a significant portion of the water rejected by farmers had no other use, including maintaining in-stream flows. Whilst it is encouraging that the study at least acknowledged the existence of return flows, there is considerable conjecture about the actual volume of water involved, its present uses and possible end destination. In addition, whilst the FBMP forecasts a change in distribution efficiency from 70 per cent to 85 per cent, Marsden Jacob and Associates (2006) offer a more cautious outcome suggesting a change from 70 to 80 per cent as being plausible. The upshot of the work by Marsden Jacob and Associates is that there is considerable conjecture about where the water purportedly 'lost' from the Goulburn Valley is presently going. Moreover, redistributing this water under the guise of irrigation efficiency runs the risk of depriving existing users with low ranking claims, including environmental beneficiaries.

There are two key issues here. First, water is invariably fugitive and measuring it with precision is costly and difficult. This is not unique to Australia and as we noted in the earlier section there are numerous projects around the world where the purported 'water savings' turned out to be much less than the original estimates used to justify the project. Second, the scale of analysis and the incentive to focus on local water use invariably leaves downstream users worse off. Without a clear view of the quantum of return flows before embarking on a 'modernisation project' it will always be difficult to assess the actual detriment to downstream users/uses. Moreover, once the project is completed it will be costly and difficult to redistribute the resource in its original configuration. This is further complicated in the context of the FBMP since one third of the water 'saved' is purportedly to be used for environmental benefit. Since there is uncertainty about the quantum of water presently accruing to 'the environment' under the status quo, it will not be possible to test whether the 75 GL assigned for 'the environment' represents an increase or decrease in environmental amenity.

[8] For those less familiar with irrigation it might seem odd that water would 'return' via an outfall from an irrigation network. However, irrigation is not a precise science and the water drawn off by farmers cannot always be judged accurately (say in the instance where a farmer has ordered water but rainfall forces her to 'reject' the flow for fear of waterlogging). The key issue of concern here is what happens to those flows thereafter.

Notwithstanding these uncertainties, inconsistencies and potentially flawed logic, the Federal government announced its support for the FBMP in March 2008 following the 21st meeting of the CoAG. In reaching this decision, the Commonwealth "agreed in principle to fund 90 per cent of the project costs, up to $1 billion of the Stage Two Food Bowl Project in Victoria, subject to a due diligence assessment and delivery of half the gains in additional flows to the Murray River" (CoAG 2008a, p. 7). The Commonwealth also signaled to other states that it intended to continue down the path of 'modernising irrigation' and funding additional 'water saving' projects. The largesse of the Commonwealth at the July meeting of CoAG gave effect to this commitment.

Regrettably, the mythology that attends 'water use efficiency' projects seems likely to be perpetuated. Even within the academic profession there are signs that the fiscal suasion of the Federal government can override water distribution logic. In June 2008, the Federal government announced $8.6 million of funding to two universities that have long and distinguished histories in hydrology. The project reportedly aims to "find ways to make better use of the water we have, creating benefits for both farmers and the environment" and to "provide farmers with practical ways to make the most of available irrigation water supplies – including rainfall and recycled water – through better planning, technology and predictive tools" (Wong 2008b, p. 1). Unfortunately, there is no indication that the project will assess the impact of these measures at a wider and more appropriate scale.

On a more cynical note, the political allure of the water use efficiency chimera shows no signs of weakening. By definition, water politics is hard work and orchestrating the genuine redistribution of a tightly held resource in favour of broader environmental interests was always going to be viewed by the polity as a zero sum game, at best. Convincing the electorate that more water can be 'created' in order to satisfy environmental interests whilst maintaining the existing distribution of rents remains far more politically palatable, even if this approach results in long run negative outomes.

5.0 Concluding Remarks

The lack of precision that has attended a project of the magnitude of the FBMP and the willingness to use public monies to fund elaborate engineering projects to 'put water to better use' is reminiscent of an earlier era of water policy in Australia (see, for instance, Watson 2007). During this earlier phase water resources were viewed as a resource to be harnessed in order to foster growth - firstly at the state level and then incidentally at the national level.

Many policy analysts were buoyed by the CoAG reforms which signalled a move to a more rational allocation of water resources and greater concern for the underlying requirements to maintain ecosystem health. There was also evidence of a more integrated consideration of resource management as manifested in the Murray-Darling Basin CAP, for example. Nevertheless, state governments, arguably in an effort to do the best for their constituents,

had generally resisted calls for national control of water resources, unless coupled with substantial financial incentives. Decision making at the state level also encourages excessive investment in local water saving projects since this maintains the resource, and the benefits that accompany that resource, in a given jurisdiction. This approach was seen as counter-productive and resulting in narrowly defined decision criteria that often privileged particular water users in particular states over basin-wide benefits.

Against this backdrop the expanded role of the Commonwealth in water resource policy in the last two years was heralded by many as a way of accelerating reform and dealing with inter-state rivalries. After all, a national government should be able to consider issues at a basin scale and establish policies that support optimisation of the resource at that level.

Regrettably, the most recent forays of the national government fall well short of this mark. Moreover, the present enthusiasm for 'modernising irrigation' stands to replicate and even exacerbate earlier mistakes. Arguably, these decisions are also illustrative of a gross misunderstanding of the rudimentary theories necessary for making sound policy at a basin scale. As Perry (2007) observes "poor theory can lead to ineffective and even counterproductive actions. Many of the problems of water today are due to the implementation of false, erroneous or misapplied concepts of efficiency in water resource policy and management'' (p. 368). Regrettably, it would appear that national governments drawn into the politically appealing but flawed logic of water use efficiency are just as capable of presiding over the degradation of the Murray-Darling Basin as are the states.

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Water Buy-Back in Australia: Political, Technical and Allocative Challenges

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Abstract
State and Federal governments are increasingly reliant on the re-purchase of water access rights as a vehicle for bringing 'over-allocation' in the Murray-Darling Basin into check. Not surprisingly, this has attracted criticism from several quarters, usually on the basis that such mechanisms produce unnecessary hardship for rural communities. Set against this are the views of many economists who have bemoaned the modest endeavours of governments to actively use water markets and the ongoing proclivity of agencies to instead embark on public projects under the guise of water use efficiency (see, for example Watson 2008).

This paper focuses specifically on water buyback and traces recent policy episodes in this context. The paper also offers details of alternative market instruments which have the potential to improve on the current, relatively fragmented arrangements. We use contemporary examples to test the efficacy of alternative buyback instruments in the hope of informing policy formulation.

Introduction

The transformation of water policy in the Murray-Darling Basin of Australia over the past 20 years is instructive on many fronts, particularly for those with an interest in seeing political economy at work. If nothing else, the previous two decades of policy formulation have poignantly illustrated the intractable nature of reallocating resources once governments have assigned (or implied) liberal use rights. Arguably, the 'developmentalist' ethos that typified water policy for most of the twentieth century has now manifested in a series of path dependencies that would challenge even the wiliest political player.

Amongst the most instructive barometers of the changing water policy landscape has been the modified conceptualisations of market instruments as a vehicle for clawing back water extractions. Initially judged by politicians as 'not on the table', the direct purchase of water rights by governments has now become an important element for shoring up environmental claims. And yet this has not happened overnight and the recasting of 'buyback' has moved through several phases. Currently water buyback is overtly claimed as a virtuous instrument aimed at "boost[ing] the overall health of rivers and wetlands that are extremely stressed after years of over-allocation, drought and climate change" (Wong 2008). This view was not always held and, notwithstanding the enthusiasm evident in recent pronouncements, we argue that the status and application of buyback warrants closer scrutiny.

This paper is used to outline the progress of water buyback in the Murray-Darling Basin between the initial CoAG reforms of 1994 and the most recent policy episodes. The aim of the paper is not simply to provide a historical

account of the political economy of water buyback over this period. Rather, the ambition is to point towards some of the continuing challenges and potential mechanisms for resolving them. Moreover, we argue there is still some way to go before Australian governments can claim to have met their 1994 commitment to allocate water in line with the Agricultural and Resource Management Council of Australia and New Zealand [ARMCANZ] and Australian and New Zealand Environment and Conservation Council [ANZECC] National Principles for the Provision of Water for Ecosystems (see, NCC 1994).

The paper itself is organised into five main parts. In section two we trace the development of water buyback as a component of the policy framework. A synoptic overview of the contemporary status of buyback is then presented in section three. The fourth section is used to highlight some of the limitations with the existing policy approach and identify areas where improvement may occur. This is undertaken in the context of a specific case site in the Ovens Valley of Victoria before offering some brief concluding remarks in section five.

The Transformation of Water Buyback 1994 - 2008

1994 Water Reform Framework

Observers of water policy in Australia point to a number of significant reform episodes. Notwithstanding the progressive realisation throughout the 1980s that the Australian water economy had 'matured' (Randall 1980), the Council of Australian Governments (CoAG) pronouncements on water reform in 1994 represent a significant milestone in their own right. The 1994 *Water Reform Framework* embodied five key principles encompassing: modifications to pricing practices such that water prices reflected cost; introduction of two-part tariffs where practicable; separation of regulatory and water management functions; a commitment that all future infrastructure investments would meet economic and environmental criteria, and; the development of volumetric water allocations that were to be tradeable and such that they made allowance for ecological needs. Importantly, as part of their commitment to the last of these principles, governments undertook to provide water for ecosystems in a manner consistent with the underlying principles prescribed by ARMCANZ/ANZECC. Principles 2, 4 and 5 are particularly relevant in the current context and are reproduced below for convenience:

> Principle 2: Provision of water for ecosystems should be on the basis of the *best scientific information available* on the water regimes necessary to sustain the ecological values of water dependent ecosystems.
>
> Principle 4: In systems where there are existing users, provision of water for ecosystems should *go as far as possible to meet the water regime necessary to sustain the ecological values of aquatic ecosystems whilst recognising the existing rights of other water users*
>
> Principle 5: Where environmental water requirements cannot be met due to existing uses, *action (including reallocation) should be taken to meet environmental needs* (Sustainable Land and Water Resources

Management Committee Subcommittee on Water Resources 1996, pp. 7-9 – emphasis added).

These deceptively straight forward principles embody substantial practical and political challenges, particularly where the quantum and timing of current water extractions challenge even modest benchmarks for environmental sustainability. Perhaps not surprisingly then, relatively little 'real water' was made available over the next decade to meet these ambitious environmental objectives. Rather, most progress had focussed on modifications to legislation and the development of planning processes, all of which attracted financial reward from the Commonwealth since the 1994 CoAG arrangements brought water reform under the ambit of National Competition Policy and its related funding tranches. The status of progress against the environmental principles by 2005 is summarised in Table 1.

Jurisdiction (Legislation/ proposed legislation)	Consideration for the Environment
NSW (Water Management Act 2000)	Prima facie, the environment has prior right over consumptive use; Water for environmental purposes is ascribed in water sharing plans; 36 water sharing plans have been gazetted for major rivers and groundwater systems; There remains some doubt whether the plans allocate sufficient water for the environment (NCC 2005, p. 3).
Victoria (White paper – *Securing our water future* 2004 to replace Water Act 1989 and Water – Irrigation farm dams Act 2002)	Bulk entitlement for the environment established in 19 of 25 water supply systems; Rehabilitation plans in place for 5 of 11 stressed and over-allocated river systems identified in 1999 and White Paper identifies a timetable for development of others; Volumes assigned to the environment subject to review by an independent Technical Audit Panel to ensure plans are based on supporting science; White Paper foreshadows the establishment of an environmental reserve with a defined entitlement; Introduction of an environmental contribution by water users (5% payable by urban water authorities immediately, 2.5% payable by irrigators and to be phased in).
South Australia (Water Resources Act 1997 and Land Management Bill 2004)	Planning for environmental needs is based on a water planning hierarchy, ranging from the State Water Plan at the top to Catchment Water Management Plans and optional Local Water Management Plans at the bottom; Water allocation plans have been developed for all 15 prescribed water resource areas identified in 1999; Additional plans have been developed as the need has arisen; The planning framework allows for the monitoring of environmental demands for water and permits a reduction in consumptive use without compensation.
Tasmania (Water Management Act 1999)	Establishment of a state-wide Water Development Plan; Specific allocations of water for environmental purposes have been identified – minimum flows on basis of Water Management Plans – although the use of 'community values' to set environmental thresholds prevents rigorous assessment of trade-offs; Since 1999, 43 of the 45 environmental water assessments have been completed and the implementation of the Great Forester catchment plan has led to streamlining of processes.
Queensland (Water Act 2000)	Water Allocation and Management Plans have been developed to establish the balance between environmental, social and economic demands and these are to be executed through Resource Operation Plans; By the end of 2004, the state had completed only 3 of the 19 Resource Operation Plans for the systems identified in the 1999 CoAG implementation program; Independent scientific reviews have been used in some cases to inform Resource Operation Plans; In some cases (e.g. Fitzroy and Boyne Basins) safeguards within the Act can be used to vary resource allocation to meet environmental flow objectives
Western Australia (Rights in Water and Irrigation Act 1914 and its recent amendments; State Water Strategy Irrigation review 2005)	A total of 41 water planning areas are identified in Western Australia; By 2005 around two-thirds of these plans were expected to be complete; Recognized environmental water assessment methods have not been used to establish some plans and adequate record keeping to underpin planning has been found wanting in some agencies; Renewed effort to resolve these matters has come from the Department of Environment following the amalgamation of the Department of Environmental Protection and the Water and Rivers Commission.
Northern Territory (Water Act 1992)	Water planning occurs as part of the Territory's integrated resource management process; Currently, six water control districts have been declared: Darwin rural, Katherine, Gove, Tennant Creek, Ti-Tree and Alice Springs; The water management strategy for Ti-Tree has been completed and three others were scheduled for completion in 2005; Notwithstanding some debate about the robustness of some of the science used to develop this strategy, the NCC has concluded that the process adequately accounts for the needs of the environment.
Australian Capital Territory (Water Resources Act 1998)	A Water Resources Management Plan is developed under Environmental Flow Guidelines before any consumptive use allowances are made; Plans are made at the sub-catchment level; Planning for all 32 sub-catchment and groundwater has been completed.

Table 1: Progress against delivering environmental objectives by jurisdiction (Source: Adapted from NCC 2004)

It is also informative to briefly consider how the state jurisdictions were considering the issue of reallocation (i.e. Principle 5) during this phase. In Victoria, for example, the Government released its White Paper titled *Securing Our Water Future Together* in June 2004. The stated environmental aspiration of the Victorian government at that time was "to have healthy rivers, floodplains, estuaries and catchments" (DSE 2004, p. 38). The principal means of achieving this was via the establishment of Environmental Water Reserves for each of Victoria's river systems. Where over-allocation was already apparent, the level of each Reserve was to be set in a manner that was consistent with the principles of adaptive management and by applying the precautionary principle (DSE 2004, p. 44-47). Arguably, this would appear not to deal directly with the thorny issue of reallocating water.

On a more practical note, the reforms in Victoria resulted in what was formerly termed 'sales water' (i.e. a low reliability access right) being converted to a tradable right, of which 20 percent was then administratively assigned to the Environmental Reserve with the residual accruing to irrigators. Other measures envisaged as building the Environmental Reserve included "practical restoration measures" like decommissioning Lake Mokoan, funding of water use efficiency in irrigation, investing in infrastructure to reduce distribution losses, donations and the substitution of recycled water of suitable quality. At this point markets and buyback were mooted as possible options although the government was keen to point out that it was "aware of the potential socio-economic side-effects" of this approach and emphasised that its main criteria was to "as far as possible …provide long-term, environmental, social and/or industry benefits" (DSE 2004, p. 49). Interestingly, relatively little was made of the need for economic efficiency in delivering these outcomes.

In sum, the response to the original CoAG framework was characterised by variable progress across state jurisdictions and a heavy emphasis on planning and the development of legislation and administrative processes. Commitment to noble philosophies was clear but relatively limited delivery of fungible water to satisfy environmental claimants actually occurred. The prospect of purchasing water rights to achieve environmental ends had received some policy attention although this was far from the preferred response. When water was being assigned to an Environmental Reserve, it often had inferior claims – say in the form of converted sales water in Victoria. Moreover, at this point there was (and remains) little evidence to suggest that the Environmental Reserve was itself being considered in any other form than a volume of water, where more Gigalitres were seen to crudely equated to greater environmental benefits.

The Living Murray

Before moving to consider how buyback has evolved as part of subsequent rounds of CoAG, it is worth noting that other policy initiatives were circumscribing the water reform agenda at this time. In response to growing concerns about the environmental health of the River Murray, the Murray-

Darling Basin Ministerial Council released its *Living Murray* discussion paper in July 2002. The discussion focused on three main reference points, (350, 750 and 1500 Gigalitres) again specified solely in terms of a volume of water to be allocated to satisfy ecosystem needs. After a tortuous consultative process (see, Crase, Dollery and Wallis 2005) the MDBMC settled on reallocating 500 Gigalitres as a first step to restoring the ecological health of the River Murray. This outcome was heavily influenced by the Federal government with the Prime Minister of the day announcing that $500 million would be allocated to address the declining health of the River Murray. Each of the southern jurisdictions agreed to contribute to the 500 Gigalitre target with the majority being sourced from New South Wales (249 Gigalitres) and Victoria (214 Gigalitres).

As with progress against the CoAG water reforms, the achievements of the Living Murray initiative vary across states. For instance, by July 2008 the Murray-Darling Basin Commission was reporting that 133 Gigalitres of water had been 'recovered', most of this being attributed to Victoria (120 Gigalitres). New South Wales had 'recovered' no water at all, although projects expected to yield 237 Gigalitres were listed as 'ready for implementation' and a further 30 Gigalitres was attributed to projects that were 'under investigation'. Again, the definition of environmental restoration in the Living Murray is distinguished almost exclusively in volumetric terms. The mechanisms by which various water products are accounted for is also somewhat opaque and variable. For example, the legislatively-converted sales water in Victoria, which coincidentally equates to the entire 120 Gigalitres claimed to have been 'recovered' in that state, needs to be meaningfully comparable with a range of other 'recovery' mechanisms. In this context, the reconfiguration of irrigation systems in the Goulburn-Murray irrigation district will purportedly yield 25 Gigalitres of water for the Living Murray. It is not at all clear how these 25 Gigalitres which derive from 'water use efficiency' measures, that are themselves of questionable status, will ultimately stack up against those Gigalitres sourced by legislative fiat[9]. A similar question circumscribes the status of different water products purchased from the market.

In 2008 the Living Murray Initiative had three projects focussed on purchasing water on the market and which met the criteria for the Eligible Measures Register. The projects were anticipated to yield up to 195 Gigalitres of water and were viewed by jurisdictions as being "essential if the Living Murray Initiative is to reach its volumetric and financial targets" (NWC 2008, p. 12). Clearly, buyback was being acknowledged as a realistic means of dealing with the reallocation issue in the context of the Living Murray project by this time, and yet there remains considerable doubt about the sincerity with which it is being managed, which we deal with later in the paper.

2004 National Water Initiative

The earlier description of the initial CoAG reforms suggests that limited real progress was evident against the key environmental principles embodied

[9] For a review of the logical flaws with water use efficiency see, for example, Crase and O'Keefe (2009). An explanation of the water accounting used to convert TLM water to a common metric is scrutinised later in this paper.

almost a decade after reaching consensus on the 1994-95 agreement. This was in no small part due to the political difficulties associated with reallocating water and left most jurisdictions selecting options considered more politically feasible – modifying administrative, planning and consultation processes and/or using public monies to purportedly 'create' water via difficult-to-quantify water use efficiency measures.

However, increased enthusiasm for water reform emerged in 2004 when CoAG settled on the National Water Initiative. The National Water Initiative sought to resolve some of the more vexing issues that had emerged from the earlier reform agenda. More specifically, the Initiative sought to harmonise the property rights structure for water access by having all jurisdictions define rights as a share of a variable consumptive pool. Risks were also to be more clearly specified and, importantly in the current context, integrated management of water for environmental purposes was foreshadowed (NWC 2005). The specific outcomes expected to emerge from this element of the National Water Initiative were fourfold. First, there was an expectation that environmental and public benefit would be "identified with as much specificity as possible". Second, management and institutional arrangements were to be put in place to realise those environmental outcomes. Third, environmental water managers were to be given adequate "authority and resources" to meet the environmental objectives ascribed in planning documents. Fourth, there were to be "cost effective measures to provide water for environmental outcomes" (NWC 2008, p. 11).

To manage the National Water Initiative the 2004 CoAG reforms ratified the formation of the National Water Commission. In September 2004 the Prime Minister also announced the establishment of a $2 Billion Australian Government Water Fund with the lion's share ($1.6 Billion) dedicated to the Water Smart Australia Program which aimed primarily to "accelerate the uptake of smart technologies and practices in water use across Australia …[with most support] directed to practical on-the-ground projects" (NWC 2005, s1-1). Very limited financial support was foreshadowed for buyback at this time with most emphasis given to supporting "improvements in irrigation infrastructure", or activities that "advance efficiency improvements on on-farm water use", or "develop water efficient housing design" (NWC 2005, s2-1). This was arguably at odds with the overarching desire to have "cost effective measures to provide water for environmental outcomes" (NWC 2008, p. 11) since it was widely acknowledged at the time that the market purchase of water from willing sellers was the most cost effective mechanism for recovering water (see, for instance, ACIL Tasman 2003; Crase, Byrnes and Dollery 2007; Watson 2007; Quiggin 2006).

In reviewing the progress of jurisdictions against the requirement to comply with the principles for water recovery to achieve environmental outcomes, the National Water Commission (2008, p. A30) subsequently reported that most states had "substantially completed" this action. Poignantly and in the context of water buyback, New South Wales was noted as "having a range of water recovery programs being progressed with Commonwealth support, including infrastructure and market based" mechanisms. Victoria was considered to be

in a position to have "strategies dealing with environmental water … completed by 2009". South Australia was also rated as having "substantially completed" this task and it was specifically observed that this state "supports and utilises market options to recover water". Arguably, in the jurisdictions with the most expansive irrigation sectors the National Water Commission would appear to have substantially modified its views on the acceptability of water buyback by 2008. Nevertheless, on a more cautionary note the Commission continued to observe that "selecting the most appropriate mechanisms for water recovery is a complex and challenging task with important economic and social dimensions in addition to the environmental requirements" (NWC 2008, p. 12). Perhaps the Commission is not yet completely convinced that the reallocation Principles agreed to in the early CoAG agenda require the forthright and coordinated use of market instruments – a view not shared by the authors.

National Plan for Water Security

The National Plan for Water Security was amongst the final policy declarations of the Howard government and was released in January 2007. The Plan attracted scathing criticism from some quarters, having emerged in a manner that seemed to reflect the political concerns of the time more than the environmental demands of the Murray-Darling Basin. Watson (2007, p. 1) noted that the authors of the Plan were "not claiming spurious accuracy for their major proposals. As subsequently emerged, the ten-point Plan to spend $10 Billion over ten years was prepared in haste, well away from the troublesome gaze of Treasury and Finance officials and the experienced eye of the Murray-Darling Basin Commission".

The Plan overtly supported buyback of water insomuch as it assigned an unspecified portion of the proposed expenditures earmarked for addressing over-allocation in the Murray-Darling Basin ($3 Billion) to buyback. Nevertheless, greatest emphasis was still given to alternative policy approaches in the form of "assistance to irrigation districts to reconfigure irrigation systems and retire non-viable areas" along with measures "to help relocate non-viable or inefficient irrigators, or help them with exiting the industry" (Howard 2007, p. 4). This was in addition to the $6 Billion already specified in the Plan for modernizing irrigation at taxpayer expense. In a more tepid tone, it was suggested that "where necessary, entitlements will also be purchased on the market" (Howard 2007, p. 4).

One of the major legacies of the Plan was the Commonwealth Water Act 2007 which sought the ceding of state powers over water resources in the Murray-Darling Basin to the Federal government. After considerable political maneuvering, all states finally agreed to relinquish control over the Basin's water resources in March 2008. Greatest resistance to the Act emanated from Victoria and it came as little surprise that Victoria's eventual agreement coincided with the decision by the Commonwealth to co-fund Stage Two of the Food Bowl Modernisation Project in Victoria's Goulburn Valley. This is estimated to cost Australian taxpayers up to $1 Billion (CoAG 2008a, p. 7) and is in addition to the funding garnered from the state government via increased water charges to be borne by Melbournians.

Water for the Future
In April 2008 the recently elected Rudd Government announced its Water for the Future manifesto. The policy committed the government to spending almost $13 Billion over ten years via "investment in strategic water priorities; sound water governance and policy; and renewed purpose and commitment in water reform" (Wong 2008b, p. 4). Reminiscent of earlier proclamations like the Howard Government's National Plan for Water Security, the policy is heavily skewed towards the 'modernisation' of irrigation at taxpayer expense. More than $5.8 Billion was assigned to "investment towards improving the efficiency and productivity of water use and management" (Wong 2008, p. 9).

Notwithstanding the similar enthusiasm for spurious engineering 'fixes' embodied in the Howard government's Plan and the Rudd government's policy, the pronouncements on buyback were *prima facie* more forthright. In this context Wong (2008b, p. 14) plainly announced that the government "will be purchasing water to put back in the rivers". The budgetary allocation for this activity was to be in excess of $3 Billion and was foreshadowed as being complementary to the infrastructure programs and other earlier commitments made under the Living Murray program and the Snowy initiative.

On the basis of these recent declarations proponents of buyback could be forgiven for feeling cautiously optimistic. After all, buyback programs have clearly moved on from having been initially conceived as the least preferred political alternative in the early phases of reform. They would also appear to have surpassed the phase where they received lukewarm support with relatively undefined budgets and almost begrudging acceptance of their policy usefulness. Finally, there appeared to be some enthusiasm for buyback programs with a defined budget allocation, albeit less than the sum assigned for subsidising irrigation infrastructure. Surely, this would become an important vehicle for restoring balance in over-allocated systems in the Murray-Darling Basin.

An Overview of the Status of Water Buyback in the Southern Murray-Darling Basin
In the previous section we noted that the status of water reform generally varies across state jurisdictions. This is no different for water buyback programs, although buyback is also complicated by programs developed and managed under the auspices of the Murray-Darling Basin Commission and the recently established Commonwealth Environmental Water Holder. To shed some light on buyback we briefly summarise the publicly available data on some of these programs but specifically focus on activities in New South Wales and Victoria and the Commonwealth's water buybacks. We acknowledge that other buyback programs have operated in the Basin, such as the pilot program operated by the Murray-Darling Basin Commission in 2007 and the earlier activities of Water for Rivers. However, we restrict our discussion to contemporary programs in the interest of brevity.

RiverBank

The New South Wales government established RiverBank in 2005 as its designated purchaser of water in order to address the deterioration of wetlands and river systems. State level funding for the initial components of RiverBank's work derived from taxes levied on hard waste disposal to landfill in Sydney[10] (set at about $100 Million) and the Commonwealth also provided additional funding ($72 Million). The program purportedly seeks to target specific sites in the first instance, such as the Macquarie Marshes, Lowbidgee Wetlands and Narran Lakes. The goals and objectives specified in the Program Plan 2006-2011 focus predominantly on environmental, cultural and business outcomes (DECC 2008a) although the extent to which this then translates into annual targets and activities is less clear. For example, the 2008-09 Annual Plan traces indicative investment targets - measured in terms of the total dollars expended (see, DECC 2008b p. 2) - but the Plan is less clear on the actual achievement of environmental targets. RiverBank water was first used in April 2008 to support a bird breeding event in the Macquarie Marshes. This amounted to the modest release of 693 Megalitres to accompany an 8,000 Megalitre release as part of the Macquarie-Cudgegong Water Sharing Plan. Regrettably, there appears to be no mechanism for tracing the effectiveness of the use of the resource in this or other contexts that would allow for an ongoing assessment of the cost effectiveness of achieving environmental impacts.

Although the Program Plan leaves open the possibility of employing a number of acquisition methods, most licences to date have been acquired using an expression of interest (EOI) process. The published criteria upon which EOIs have been assessed include the size of the licence; restrictions that pertain to a licence; the price per unit share; and the type of licence (DECC 2008c). Reference is made in the RiverBank Planning documentation to a range of other criteria which may be invoked to rank the water that is on offer, such as the "opportunities for enhancing the current environmental water rules with additional flows" and "potential for strategic alliances" (DECC 2008a, p. 13). However, it is not at all clear how each of these is rated by the agency in the context of specific bids.

In 2008 RiverBank also acted as the single purchasing desk for the New South Wales component of the Living Murray Initiative and all other water buyback programs in the state. This adds some confusion to the activities of RiverBank insomuch as the Living Murray Initiative purportedly aims to target different environmental sites to those specified in RiverBank's original planning. This is further complicated by the fact that the criteria by which 'new environmental water' [new e-water] are assessed under the Living Murray should differ from that used for RiverBank's targeted environmental assets. To illustrate this point it is necessary to understand some of the administrative accounting measures in place to track progress in the Living Murray Initiative.

Earlier we noted that the Living Murray Initiative was a cross-jurisdictional agreement where states agreed collectively to return a total of 500 Gigalitres of water to the River Murray. This relatively simple policy goal belies the

[10] Economists would invariably struggle to rationalise the efficiency impacts of these arrangements.

complexities of water accounting and, as we will see, it is these complexities that can encourage perverse outcomes. Since each jurisdiction has specified its water entitlements in different forms, a volumetric measure in one state is not always equivalent to that in others. Even within jurisdictions there will be non-trivial differences that reflect the reliability with which a given volume of water can be accessed in a given location. For example, New South Wales has three main categories of water access licences or water products. High security products have a fixed and relatively secure volume of water where the frequency, timing and delivery are largely controlled by the licence holder. General security products vary in volume depending on seasonal conditions and inflows to storages. Annual allocations for general security licences only accrue once higher claims (e.g. high security holders) have been met, although release and control of the allocation is largely at the discretion of the licence holder. The lowest priority accrues to supplementary access products. Here, magnitude, frequency and timing of access are all subject to specific declarations – say in the event of a very high flow in a stream (DECC 2008a, p. 17). In simple terms a Gigalitre of high security water is not the same as a Gigalitre of supplementary access water and a mechanism is required to convert these to a common metric since the Living Murray Initiative has specified the objective in a single volumetric measure - 500 Gigalitres.

The Murray-Darling Basin Commission has developed a number of Living Murray Business Plans approved by the Murray-Darling Basin Ministerial Council. Despite the use of some rather daunting terminology, the Business plans provide insights into how this methodology has evolved over time and the implications for water buyback. At the core of the issue is the calculation of what is termed 'long term cap equivalent' [LTCE] water. The LTCE is the volume of water calculated using the best practice modelling of the Cap on extractions to determine the long term contribution of the 'water parcel' to the Cap or its "potential contribution to long term average flows in the relevant river valley" (MDBC 2005, p. 49). In essence, what this process attempts to do is capture and control for the variability that attends different water products and reduce it to an 'average' contribution to flows.

There are three potential limitations to this approach that need to be kept in mind. First, the modelling that is used in this instance is not a precise science and if future predictions of climate change prove accurate, the impacts on the actual water availability seem likely to be significant. More specifically, the estimated volumes generated by the LTCE method rely heavily on historic data relating to yield and rainfall. Thus, low surety products like supplementary access licences, may well yield very little, if any, water in the future as the frequency of high flow events decrease with climate change. There is no evidence that this has been deliberately included in the LTCE calculations or the manner in which agencies have considered buyback options presented as part of the Living Murray. Moreover, this must surely shed some doubt on the usefulness of low reliability products in achieving the prescribed environmental outcomes.

Second, whilst administratively convenient, when deployed as the sole metric the LTCE approach potentially increases the focus on the *volume* of water as a policy objective in its own right. Ecological systems are far more complex than this and the environmental health of any stream will be influenced by a range of ecological and hydrological factors, not just the volume of water. Hillman (2009) summarises a number of these dimensions such as the differing classes of flow and water temperature, for example. Put simply, the purported *volume* of water at the disposal of an environmental manager appears to have become the sole de facto environmental metric in many instances. The upshot is that agencies may be buying water products (which may or may not ever deliver a flow) on the basis of volume and the link between the purchase and environmental restoration is weakened as a result

Third, notwithstanding the collaborative façade of programs like the Living Murray, strong rivalries remain between states and their water bureaucracies. Against this backdrop, the determination of the LTCE for different water products has the potential to take on a political dimension in spite of the insistence that the LTCE "in itself does not represent a policy position" (MDBC 2005, p. 49). After all, if a jurisdiction can influence the LTCE calculation such that a relatively low value product in their state is granted a generous LTCE then that state can claim to have met its obligations to recover water but limit the economic and political costs of redistribution.

A review of the LTCE (Cap Factor) over a number of years shows that in 2005 the parties to the Living Murray were aware that its configuration at that point did "not encourage the purchase of supplementary allocations as its long term Cap equivalent may reduce over time" (MDBC 2005, p. 52). Nevertheless, by 2007 a Cap Factor of 0.37[11] had been assigned to Lower Darling Supplementary Licences in New South Wales providing some incentive for their purchase[12].

Against this background the New South Wales Department of Environment and Climate Change announced in November 2008 that it was "ahead of the pack on environmental water" (DECC 2008c, p. 1) having purchased 23 Gigalitres of supplementary access licence from Tandou Limited. The press release from the Department proudly proclaimed that this single purchase "represent[ed] almost one tenth of NSW's water recovery target" making a representative of the Department "confident that it is on track to achieve its share of the program by 30 June 2009" (DECC 2008d, p. 1). Given the aforementioned caveats about the calculation of the volume of water that attends this $34 million purchase and the doubt over the environmental outcomes that it might deliver, a more circumspect response might have been expected. Attending the press conference that accompanied the press release the Minister was reportedly quizzed "about the benefits of the purchase, given the savings would only be realised in big wet years when the

[11] The higher the Cap Factor the more Gigalitres the state can claim to have purchased for the environment. High security products have Cap Factors of 1.0 or higher.

[12] No Cap Factor was specified for supplementary licenses in the Darling in New South Wales in 2005 and the documentation notes that the published Cap Factors for 2007 were revised and "agreed by jurisdictions at 15 Sept 2006" implying a partially negotiated process at least (MDBC 2007, p. 59).

environment would be receiving a big drink anyway" (Skulthorp 2008). The Minister reportedly justified the expenditure on the grounds that "'times are tough' for companies like Tandou" (Skulthorp 2008) although apparently not so tough that it could be persuaded to part with any of its general or high security water products.

In sum, there appear to be some grounds for questioning the link between the water products being purchased by RiverBank and the environmental objectives assigned to the Living Murray and the other state-based environmental programs for which RiverBank acts. There would also appear to be grounds for greater scrutiny of the range of political and administrative influences that may come to bear in these cases since there is potential for these to substantially undermine the efficacy of the buyback approach.

DEWHA Commonwealth Environmental Water Holder

Earlier we noted that the Water for the Future manifesto announced the Commonwealth government's intention to allocate about $3 Billion to purchase water over five years. In February 2008 the Minister declared that the first allocation of funding was set at $50 Million and purchases were to be completed by the end of June 2008. Funding was also announced for the following three years ranging from $157 Million to be spent in 2008-09 to $468 Million for purchases in 2010-11. At the completion of the first round $47.1 Million had been expended and 34.3 Gigalitres of water product purchased (Breckwoldt 2008).

Like the RiverBank model, the DEWHA processe requires the seller to submit a non-binding EOI with offers then being assessed by DEWHA on the basis of 'value for money'. To help guide the process DEWHA reportedly employs two principles to help prioritise purchases. These are:

- "The availability of the water for regular allocation to high and medium priority environmental assets such as wetlands that have been significantly adversely affected by water extractions
- The extent to which the withdrawal of the water from the regular allocation to irrigators will improve the overall health of the catchment from which it is taken and/or the Murray-Darling system as a whole" Breckwoldt (2008, p. 7).

The combined impact of these principles was that the first round of DEWHA buyback focussed on water that could be delivered to 'priority assets', being limited to Ramsar wetlands; those wetlands listed in the Directory of Important Wetlands in Australia; ecosystems supporting listed threatened species and; those migratory birds and communities listed as being threatened. This manifested in a purchasing strategy that sought water entitlements from the Murray and its tributaries downstream of Menindee Lakes and the regulated portions of the Lachlan, Macquarie and Gwydir Rivers. At the time DEWHA acknowledged that purchases of water from other catchment areas of the Darling had the potential to deliver benefits, but the unregulated nature of

these entitlements and the conditions that attended them[13] made purchase "much lower priority compared to the catchments indentified above" (Breckwoldt 2008, p. 7).

Notwithstanding these criteria, DEWHA and the New South Wales government attracted considerable attention when they publicly announced the purchased of Toorale Station, located at the junction of the Darling and Warrego Rivers slightly downstream of Bourke[14]. The primary motivation of the $24 Million deal was to deliver "a significant boost to environmental flows in the Darling River, whilst also providing a boost to the NSW reserve system" (Wong and Tebbutt 2008, p. 1). The water products that came with the purchase were announced as being equivalent to 20 Gigalitres per year[15] (Wong and Tebbutt 2008, p.1), although former National Party leader and director of the firm that until recently owned the property had a more jaundiced view. In an interview with ABC television Mr Anderson noted that "Toorale hasn't grown anything for years because there hasn't been any water" and "that unless everything's going to turn around and we're suddenly going to get reliable water flows again ... I'm afraid what the taxpayer's actually bought is air" (ABC 2008, p. 1).

Whilst it might be expected that former political adversaries would differ on this point, this case again highlights the urgent need for a clearer link between the purchasing strategy employed in buyback and the environmental objectives ascribed in the policy. In the context of the first phase of the DEWHA buyback program proper, which comprised mostly general security products purchases from preferred catchments, Breckwoldt (2008, p. 72) urges similar action:

> "The evaluation of future purchases will be difficult without clarification of the goals and objectives of the water purchasing program through specification of the required water regimes. The Environmental Water Plan should drive acquisition of water as soon as possible. There is a need to clarify targets to support the overall goal of water for the environment. The objectives and targets of the Basin Plan need to be clarified and then used consistently"

In a more general context the NWC has expressed similar reservations about the slow progress against those components of the National Water Initiative that relate to integrated management of water for the environment. One of the key priorities identified in this field is to "undertake an evaluation of the cost-effectiveness and environmental-effectiveness of the various recovery mechanisms in the Murray-Darling Basin including an examination of any overlap and duplication among programs" (NWC 2008, p. 13).

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[13] In essence, there is no way of using these water products to deliver water to an environmental asset since, under current conditions, it is not possible to prevent downstream irrigators from then extracting the passing flow, given the nature of the licences.

[14] For those unfamiliar with the geography of the Basin, this area is well upstream of the Menindee Lakes and in the region specified by DEWHA as being of a lower priority for buyback.

[15] Presumably this was the result of a LTCE calculation, although data on this issue are difficult to derive.

Streamflow tenders in Victoria

The Victorian government has invested substantial resources in the development of Regional Sustainable Water Strategies with the first of these being released in October 2006. These strategies cover water resources in a defined area and provided part of the impetus for the development of streamflow management plans that detail the sharing arrangements for streams. In essence, streamflow management plans specify a minimum flow regime to sustain or improve the ecological health of rivers. In order to achieve this flow, limitations are placed on the amount and timing of extractions. For example, in summer months irrigators may be placed on a rotation that limits when they can withdraw water or banned from extracting water entirely, depending on flow conditions.

Streamflow management plans provide for a staged modification to water extractions over several years. However, in order to accelerate progress towards the achievement of streamflow targets, the government conducted a pilot tender process for the Olinda, Stringybark, Pauls, Steels and Dixons Creeks in mid-2007. The streamflow tender involved licence holders offering to modify the conditions that attend their licences in return for financial assistance. This reduced to two main offers from irrigators – agreement to reduce the volume of their licence and/or agreement to cease extractions when streamflow reached a predetermined trigger.

The tender process was managed by Melbourne Water with the broad criterion of 'value for money' stipulated as the basis for tender assessment (Melbourne Water 2007a, p. 1). Closer inspection of the tender forms would suggest that the three areas of concern were the extent to which the bid would contribute to environmental flows, the bid price and the rapidity with which changes would be made (see, Melbourne Water 2007b, p. 1). Whilst a review of the tender was proposed, it has yet to be released. Nevertheless, the Department of Sustainability and Environment reports mixed success with some farmers proving more enthusiastic than others and a modest 55 Megalitres being relinquished as part of the tender (DSE 2008, p. 323).

Streamflow tenders have one important advantage over volumetric EOIs insomuch as there is potential to more clearly specify the environmental impacts of a water buyback relative to using a volumetric recovery target. Here there is scope to at least account for the timing of flows in order to address the most significant environmental stresses. However, there are other perverse outcomes that need to be considered. First, the purchaser needs to be assured that the actions on offer will actually deliver against the streamflow target. This will be particularly problematic if data on the history of use are not available or of inappropriate scale. Under these circumstances it becomes possible for holders of sleeper and dozer rights to tender volumetric licences such that no discernable improvement on the flow target emerges. Obviously, this raises the overall cost of delivering the streamflow target as sleeper and dozer rights need to be 'absorbed' before any progress can be made against the flow target. Second, the purchaser needs to guard against the myopic focus on the most pressing problem – usually summer flows – at

the expense of generating other third party effects. In some instances irrigators (and urban water utilities) have been encouraged to construct 'winter fill' storage which can then be accessed in summer to offset bans on extraction. This runs the risk of ignoring the consequences of excessive winter extractions and is reminiscent of earlier policy episodes when the shift from surface water to groundwater extraction escaped the gaze of the water bureaucracy[16]. Put simply, governments need to guard against paying a premium for permanent 'solutions' to over-extraction that later prove wanting and require additional calls on the public purse.

Challenges to Buyback – An Example from the Unregulated Ovens River

The preceding discussion points to at least two of the fundamental challenges facing water buyback. Arguably, these might be classified as tests to the standard concepts of technical and allocative efficiency. On the one hand, the problems associated with predicting the impact of a given buyback expenditure on fungible and deliverable water undermines the conditions required to gauge technical efficiency. After all, you can hardly identify the lowest cost method of sourcing a volume or flow of water if there is considerable uncertainty circumscribing the relationship between different water products and the volume or flow that purportedly attends them. On the other hand, the absence of a genuine environmental metric continues to frustrate the conventional measurement of allocative efficiency. Even if water was being purchased at lowest cost, it may still fail to deliver the required environmental outcome unless it has the necessary delivery characteristics. As noted earlier, this is likely to be particular problematic when there is a strong focus on a volumetric metric at the expense of all other considerations, like the nuances of flow, and vaguely defined environmental outcomes. Using this broad approach we now briefly examine a water buyback program mooted for the unregulated portion of the Ovens Valley in Victoria. Our aim is to highlight the technical and allocative complications, even though the allocative component is less problematic since the environmental outcomes are more clearly linked to flow rather than volume. This analysis tentatively points towards potential mechanisms for improvement.

The Upper Ovens Valley in northern Victoria comprises a large unregulated system with a substantial volume of licensed extractions for urban and irrigation users. The environmental attributes of the Ovens are also highly prized at the State and National levels with the Lower Ovens listed as a Heritage River, largely because of its active floodplain and healthy native fish communities (Vogell et al. 2007). A draft streamflow management plan was developed for the Upper Ovens in 2003 with the aim of "clarifying how much and when water can be harvested from the Catchment and the minimum flows required in streams to maintain the environmental health of waterways" (DSE

[16] It is a moot point whether the radical increase witnessed in groundwater extractions was bureaucratically 'unpredictable' or simply politically expedient. In the case of the trial Streamflow Tender, Melbourne Water (2007c, p. 10) lists "increasing the size of your existing off-stream dam", "constructing a new groundwater bore" and "pumping from your existing groundwater bore" as feasible ways of increasing water availability or water use efficiency. Accordingly, all of these activities potentially qualified for support from the public purse. This would appear to be at odds with the dominant thinking that groundwater and surface water management should be considered jointly.

2003, p. 9). The greatest immediate challenge is the maintenance of minimum flows during dry summers when competition for the resource is intense. Since this is an unregulated stream, environmental objectives are managed by constraining the rate at which water is extracted during times of severe scarcity, say by restricting or banning extractions in line with 'run of river' metrics. A further complication in this instance is the strong interaction between surface and groundwater which has been strengthened by gold dredging in the past (DSE 2003, p. 42).

One of the key recommendations emerging from the draft streamflow management plan for the Upper Ovens was a minimum environmental water provision defined as a daily flow at Myrtleford of no less than 100 Megalitres. This broadly equated to a ban on irrigation 6 years in 10 for an average period of 4.5 weeks. In the context of the current horticultural practices in the region, this represents a significant contraction and points to the need for substantial structural adjustment. It was originally foreshadowed that the plan would achieve this target by the 10th year of operation, although earlier implementation was seen as desirable on the proviso that "adequate measures to address supply reliability [could] be implemented" (DSE 2003, p. 36). A community consultation phase followed the release of the draft streamflow management plan which preceded the Minister requesting additional technical work prior to its ratification. At the time of writing, no streamflow management plan is in place although additional work has been undertaken (see, for example, SKM 2006) to inform another round of consultation. The more recent technical work highlights the necessity for a higher daily flow at Myrtleford (137 Megalitres) and thus implies even more radical adjustment to agricultural practices in the region.

Perhaps anticipating the political costs likely to attend implementation of the Ovens streamflow management plan, representatives of the various state departments commenced discussions with landholders about the feasibility of a streamflow tender mechanism in mid-2008. At the time, the model employed by Melbourne Water (described earlier) was being proffered as an option (per com Kerry Murphy December 2008).

There are several significant challenges to the implementation of a tender instrument in this context, particularly given the deficiencies identified with earlier streamflow tender. First, the total volume of licensed extraction in the Upper Ovens vastly exceeds average use. More specifically, the maximum recorded use in the catchment was only 59% of licence volume in 2003 (DSE 2003, p. 39). This has non-trivial implications for the effectiveness of any EOI process, particularly if the buyer is unable to accurately trace history of use. Put simply, accurately tracing history of use is a precondition for ensuring that any purchase of licenses manifests in an authentic reduction in the demands on streamflow.

The agency charged with monitoring water use in the Valley (Goulburn-Murray Water) has a policy of monitoring water supplies "in principle" (DSE 2003, p. 41). This "in principle" approach has resulted in relatively poor calibre historical data upon which a potential buyer might assess the

environmental merits of purchasing different parcels of water. For example, the 2003-04 Water Accounts for the Ovens Valley reveal that "licenses on unregulated streams are not currently metered and water usage is an estimate provided by Goulburn-Murray Water" (DSE 2005, p. 81). Coupled with a definition of sleeper licenses as being those "which have not been used for 10 years or more and have no infrastructure" (DSE 2003, p. 40) it will be difficult to distinguish which are genuine sleeper or dozer rights from those whose purchase by the state would actually impact on extractions.

A historical precedent has also been set that ascribes value to sleeper licences and "these licenses, regardless of use have a legitimate entitlement to water" (DSE 2003, p. 40). This forms a second major challenge for a tender-based buyback in the region. More specifically, a buyback scheme would prima facie need to compete with other potential purchasers of sleeper licences. Historically, relatively little water has been traded in the area (see, for example, Watermove 2009) although it is feasible to trade water downstream to other defined regulated users, albeit at an exchange rate of 1:0.81. Whilst such trades might appear likely to benefit the streamflow target of maintaining water in stream at Myrtleford, the basin-wide impacts could prove detrimental, especially if sleeper or dozer rights are being sold and activated. Thus, whilst the tender process might seek to discriminate against the purchase of unactivated licences or portions of licenses, there may be little choice other than to purchase these licenses or run the risk of their activation downstream.

A third major consideration relates to the congruence between groundwater and surface water in the region and the monitoring that has historically attended extractions from both sources. The floor of the Upper Ovens is characterised by course sediments and rocks with large quantities of groundwater interacting with surface flows. Groundwater is easily accessible in most of the Valley by simply digging a hole in the valley floor. These structures are referred to locally as 'draglines' and are commonly accessed by irrigators when bans on surface water irrigation are put in place. Historically, some draglines have been treated as equivalent to surface water extractions and others not, depending in part on the proximity of the dragline to the stream and the arbitrary distance applied to define the water as being congruent at the time. The upshot is that even where water metering records do exist, they may not fully capture the 'environmental worth' of modifying or halting a particular extractive activity. In addition, and unlike the streamflow tender conducted by Melbourne Water, there would appear to be even less scope for using subsidies for groundwater extraction to offset surface water extraction and thereby meet the objectives of the streamflow plan[17]. In this context DSE (2003, p. 42) noted that "the exact nature of the relationship between groundwater use and streamflows […] may vary depending on the particular circumstances of the extraction site". The costs of an agency gaining sufficient knowledge of this relationship in order to assess the merits of alternative buyback offers appear prohibitive.

[17] As noted earlier, the logic of this approach is itself dubious.

Clearly, these circumstances produce major technical challenges to the use of buyback in its current form as a vehicle for achieving structural adjustment in the Upper Ovens. Nevertheless, these should not be insurmountable or taken to imply that buyback has no role in this context. Rather, we argue that sharpening the focus of buyback schemes in a manner that takes account of information deficiencies holds considerable promise.

Most of the challenges described in this section derive from information asymmetries between the agency conducting the buyback program and potential participants. For example, farmers are generally well aware of the interrelationship between groundwater and surface water on their properties, even if the state agency is not. Similarly, farmers are more inclined to know the extent to which they hold 'sleeper' or 'dozer' licences than is the state, at least until sufficiently robust metering data is developed. In this contexts the potential seller has the ability to exploit the limited knowledge of the purchaser, as may have occurred in other instances of buyback highlighted in this paper.

The problems of the Upper Ovens buyback can be addressed by focussing the tender at a scale that recognises the deficiencies in information and takes advantage of existing institutions capable of coordinating local action to meet the prescribed environmental outcome. In the case of the Ovens Valley, many of the extractive users are affiliated with The Tobacco & Associated Farmers Co-operative Limited (TAFCO), a legacy of the former prominence of the industry in the region. Information asymmetries between members of TAFCO are likely to be less severe than those that exist between the state and individual farmers. Accordingly, a coordinated bilateral agreement struck between the state and TAFCO may yield superior results to tenders based on individual farmer participation. A critical element of such an agreement would be the necessity to tie financial incentives directly to the achievement of streamflow targets. This could include financial sanctions for non-compliance, as would be expected with most agreements in the private domain. In order to maintain the core elements associated with buyback, the program would need to be structured upon standard benefit cost analyses in order to avoid capture by political interests.

The intuitive appeal of this approach is also supported by a more rigorous analysis by Pincus and Shapiro (2008). Pincus and Shapiro (2008) argue that welfare gains can be achieved by reaching a collective agreement with farmers on the sale of their water rights relative to voluntary sales by individual irrigators. Notwithstanding that the model they propose embodies significant practical constraints[18] conceptualising buyback at an appropriate scale seems to be one of the simplest steps to improving its effectiveness.

Concluding Remarks

Attitudes to water buyback have undergone a progressive transformation over the last decade and a half. The initial resistance to buyback derived primarily

[18] The approach partially relies on the threat of compulsory acquisition to help gain unanimous agreement amongst farmers re the total quantum of water to sell.

from the perceived political costs of this approach, notwithstanding the commitments given to reallocating water in favour of the environment as early as 1994. Buyback is now a key component of water policy, at least at the rhetorical level.

We have observed that the acceptance of buyback as a policy instrument has not come easily and the perceived political costs would appear to continue to have some influence over the sincerity with which it is being pursued. There are several prominent instances outlined in this paper which highlight the need for greater scrutiny since there is a strong incentive to publicly overstate the magnitude of buyback, in order to appease environmental interests whilst securing water products from agriculture that amount to a limited reallocation, at best. The costs of this approach may well prove severe even in the medium term, with limited progress on the environmental front and more intractable adjustment problems being created for a sector that continues to rely on largesse from the public purse, albeit in a different guise.

Buyback in the Murray-Darling Basin is also arguably fragmented and attention to planning would appear deficient. This has not only allowed for more political intervention than is desirable, it has also limited the potential gains from the mechanism. Increased transparency and planning to define and measure suitable water products and endeavours focussed on the management of those products to deliver measurable environmental benefits are required.

The case of the Upper Ovens Valley shows that instigating a buyback program capable of making genuine progress towards reallocation requires careful consideration of the scale and information components of the program. In that context we contend that additional work is urgently required to design buyback programs capable of dealing with these issues.

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