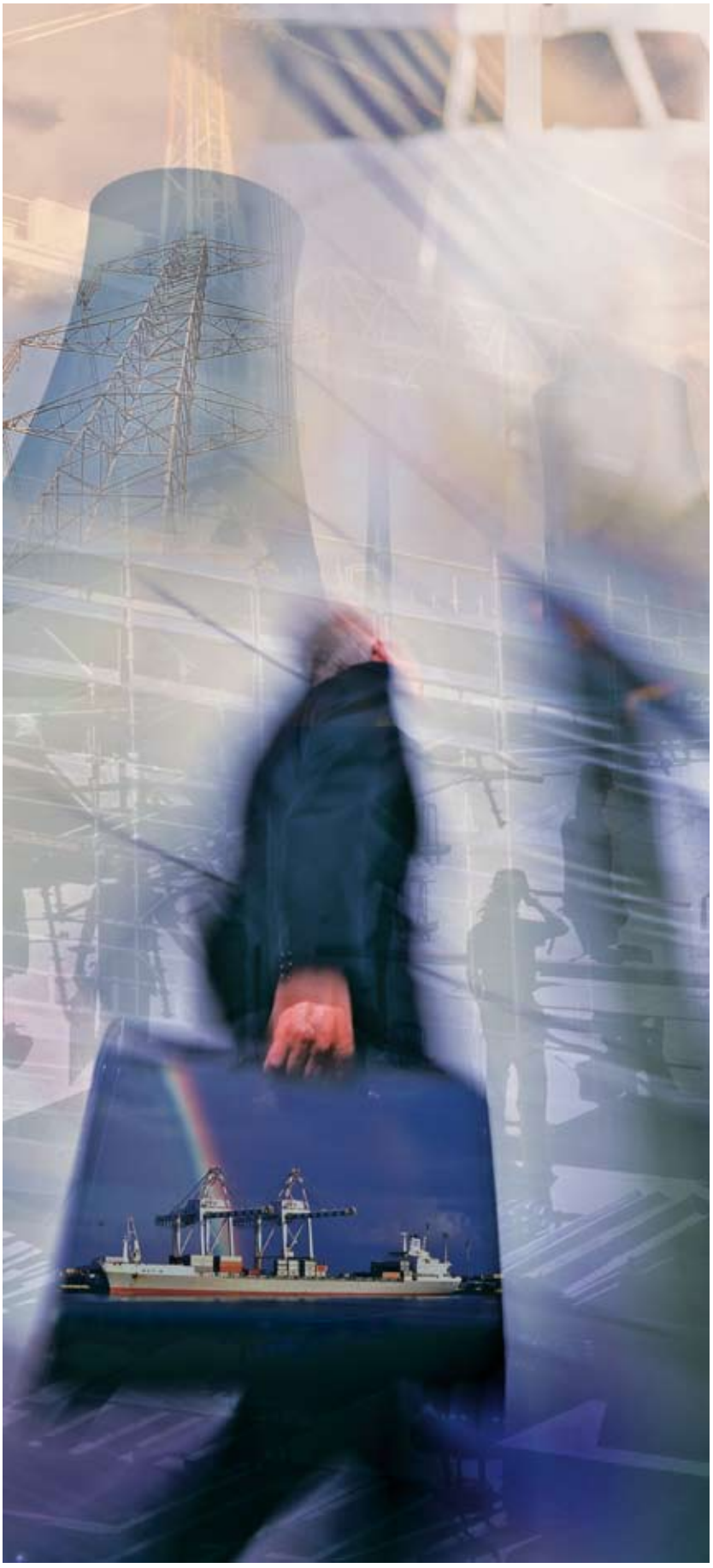

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The Paradox of National Water Savings

Lin Crase and Sue O'Keefe

Abstract
One of the claimed benefits of the federal government assuming greater control over water policy is that it will resulted in a more unified and holistic response to the extant problems in the Murray-Darling Basin. This paper is used to explore the veracity of this argument against the backdrop of recent initiatives outlined in the Federal government's 'Water for the Future' manifesto. We argue that a naïve understanding of concepts such as 'water use efficiency' 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

In April 2008 the newly elected Federal Labour government formally signalled its intention to push for a greater say in the allocation of Australia's water resources. In essence, this amounted to a continuation of the approach espoused in the Howard government's *National Water Plan for Water Security* which culminated in the Commonwealth Water Act in 2007. 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 the holistic problems of a basin and overcome the dilemmas arising from competition between differing state jurisdictions. For instance, 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).

The rationale for superordinate management of water resources in an interconnected basin resonates with many in the electorate. Interstate rivalries are well-acknowledged by most Australians and there is ample historical evidence of the difficulties created by federated decision making, ranging from the poor interconnection of railway networks to incompatible school curricula. There are also numerous international examples which can be drawn upon to illustrate the difficulties and costs associated with managing water resources across competing state jurisdictions (see, for instance, Green 2003). In addition, the extant degradation of the Murray-Darling Basin's riverine environment and

the pressing scarcity of the resource under scenarios of climate change have been 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). Poignantly (and perhaps naïvely), the Minister also contends that "[t]his 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 funding provide grounds for questioning the efficacy of the national control of water resources. Put simply, the benefits of a holistic 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. 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.

This paper is used to trace the circumstances that have led to these events. We use the paper to argue that downstream states such as South Australia, which ironically has been amongst the most vociferous supporters of an agenda that allowed for increased national intervention, will be a significant loser as a result of upstream 'renovation' of irrigation. The paper is also used 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. Section four is employed to review the *Food Bowl*

Modernisation Project (FMP) in northern Victoria. This section is also employed to reflect upon the Federal government's decision to support this project. 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 unmistakably vested in the states when the constitutional reformists chose to reject the doctrine of riparianism 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 Council of Australian Governments (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.

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. Poignantly, 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 'modernizing 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 has specifically undertaken to co-sponsor the renovation of irrigation

infrastructure in Victoria to the tune of about $1 Billion. Some commentators have viewed this generosity 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). Setting aside the financial and political dimensions to this decision 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 continued naïve support for the view that 'modernising irrigation' or investing in 'water use efficiency' can generate 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 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). Refinements were made to this definition, adding attention to consumptive use efficiency (Hanson 1960); non-consumptive beneficial use (Jensen 1967) and distribution and application efficiency (Bos and Nugteren 1974; Bos and Nugteren 1982). Despite these developments, 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; Willlardson 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 a non-consumed fraction comprising recoverable flows and non-recoverable flows (Perry 2007, p. 372).

This approach highlights the fact that not all water ostensibly 'lost' from a system does in fact constitute a loss. Accordingly, if attempting to 'save' water, it is vital to know whether the 'losses' from the system are in fact losses at all.

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). Notwithstanding these developments, 'improvements' in irrigation efficiency continue to be calculated at farm or 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 basin level compared to the field level. 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.

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).

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 quality of the recharge and aquifer tapped by farmers on the other side of the border in Mexico (p.4).

Sakthivadivel and Chawla (2002) examine 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 being already tapped by other users.

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 National Policy Thinking

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, holistic 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.

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. Fourth, changes to water charging to reflect the additional investment base are foreshadowed[1]. Fifth, some farm system adjustments, such as a reduction in the number of off-takes, 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 by improving distribution efficiency with the resulting 'savings' to be shared equally – one third being allocated to irrigators, one third being exported to Melbourne via the Sugarloaf pipeline and another third assigned to environmental uses.

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

[1] 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.

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 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. Marsden and Jacob (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 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 and Jacob offer a more cautious outcome suggesting a change from 70 to 80 per cent as being plausible.

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.

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 Council of Australian Governments (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 2008, p. 7). The Commonwealth has also signaled to other states that it intends to continue down the path of 'modernising irrigation' and funding additional 'water saving' projects. More specifically, the CoAG communiqué indicates that "[t]he Commonwealth will work with irrigators in these regions to ensure equitable consideration of funding proposals. Between now and the next CoAG meeting the Commonwealth will agree with the governments of New South Wales, Queensland, South Australia and the Australian Capital Territory on priority water savings projects in the Murray-Darling Basin for priority Commonwealth funding" (CoAG 2008, p. 7).

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 a long and distinguished history 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.

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 holistic 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 put the interests of 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). It would appear that national governments that invoke flawed logic are just as capable of overseeing the degradation of the Murray-Darling Basin as are the states.

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