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Rationalisation of Established Irrigation Systems: Policy and Pitfalls

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1. Introduction

Global concern about food security has prompted a focus on increasing productivity using increasingly scarce resources. In Australia, as in many countries, a growing population and the projected effects of climate change and shift mean that water is the focus of much of this concern. However, as in many other established economies the infrastructure designed to move water from relatively water-abundant areas to provide irrigation is aging. It requires significant investment to guard against its failure, to ensure it meets modern standards of safety, and to ensure that water is productively used and that wastage is minimised.

In accordance with the dominant global view that prioritises free trade, to which Australia subscribes, competition policy prescribes that irrigation infrastructure is provided on a 'user pays' basis - the cost of infrastructure is factored in to the cost of the water. In northern Victorian irrigation regions, where this policy has been aggressively implemented, water costs have been 'unbundled' to reflect usage, maintenance, service and infrastructure costs, so that the usage component does not form a significant part of the total water charge. In such an environment, the major infrastructure investment needed to renew irrigation infrastructure cannot be provided directly by irrigators.

The question of investment in irrigation infrastructure is common to many developed countries. In the arid states of the United States, which followed a similar 'nation-building' path in the funding of irrigation infrastructure (Lampen, 1930; Newell, 1903) irrigation infrastructure is in poor condition (US water infrastructure needs seen as urgent, 2009). Building irrigation capacity in developing countries has been identified as a priority, and major irrigation schemes are being built in China and India. However, the optimal model of investment and ownership of infrastructure is still a matter for significant debate (Abbot and Cohen, 2009). This is of particular significance when returns on commodities are subject to market distortions, so that irrigators paying for irrigation infrastructure will be competing with irrigators who are not.

The situation in Australia is of significance to any region seeking to optimise water capture and extraction for irrigation purposes. It is not clear how the current round of irrigation industry reforms will affect the industries and communities reliant on irrigation; the context, background and effects of those reforms should be closely considered.

This chapter will critically analyse irrigation industry reforms in northern Victoria, Australia. Irrigation in this region is undergoing significant organisational and infrastructure reform. With extensive assets, increasing conveyance costs and competing demands for water, managers of irrigation businesses have implemented far-reaching changes which will have flow-on effects for irrigation customers.

The social, political and legal context of these reforms is significant, so this account will commence with consideration of the national cooperative agreement that water should be managed according to the national competition agenda, the corporatisation of water authorities, the implementation of 'user-pays' principles and unbundled water charges, and the development of trade in water. Subsequent pressures as a consequence of a major drought have brought into sharp focus the environmental impact of water extractions. Market mechanisms, along with direct government acquisition of water entitlements have been directed towards reducing the irrigation 'take' from the Murray Darling system. As a consequence, in northern Victoria, modernisation, rationalisation and reconfiguration projects have been developed. These are aimed at reducing irrigation water use and contracting the coverage of irrigation infrastructure. This chapter will consider the modernisation process in northern Victoria. It will consider the implementation of a 'backbone' set of water conveyances, selected on the basis of water usage, and 'connection' back to that conveyance of channels and 'nibs'. The processes by which the 'backbone' was identified, the impact of that decision on irrigators, and the negotiation of the 'connections' program will require consideration of the formation of irrigator syndicates, the privatisation of irrigation infrastructure, and vexed questions regarding liability for failed assets, particularly on public roads and crown land. The reality of postulated water 'savings' has become a matter for political debate, and the economic and social consequences of the modernisation project have been matters of concern.

2. Irrigation policy drivers in Australia

Irrigation policy in Australia is driven by competing environmental and agricultural water needs, the cross-party acceptance of a market driven National Competition Policy (<http://ncp.ncc.gov.au/>), and increasing infrastructure costs as a result of aging infrastructure and increased engineering and safety requirements. These drivers impact at different levels and to different extents, and can, as will be seen, be derailed by short-term populism.

The irrigation policy environment, particularly in Victoria, has been characterised by a series of disruptive changes since the mid-1980s. These have delivered changes in governance, a decline in water availability, the introduction of water trading, unbundling of the water 'product' and change in the nature of the water 'right' itself.

2.1 Competition policy reform

Competition policy reform is expressed in states' commitment to a national competition agenda. The competition framework was endorsed by the Council of Australian Government (CoAG), made up of the Commonwealth and State Governments. In relation to water, the CoAG, an Intergovernmental Agreement on a National Water Initiative between the Commonwealth of Australia and the Governments of New South Wales,

Policy driver	Date	Primary focus
<i>Water (Central Management Restructuring) Act (Vic).</i>	1984	Replacement of State Rivers and Water Supply Commission with Rural Water Commission
<i>Water Act (Vic)</i>	1989	Introduced water trading Conversion to Bulk Entitlements
<i>Water (Rural Water Corporation) Act (Vic).</i>	1992	Corporatisation of Victorian water authorities
<i>CoAG National Water Initiative</i>	1995	Market principles increasingly applied to water
<i>Murray Darling Basin Commission Cap</i>	1997	Diversions from the Murray Darling Basin capped at 1993-94 levels.
<i>Essential Services Commission Act (Vic)</i>	2001	Regulation of rural water providers through the Essential Services Commission – introduction of a process to regulate water prices on the basis of cost recovery
<i>Water (Resource Management) Act (Vic)</i>	2005	Unbundling of water ‘product’ in Goulburn-Murray Water area - existing water rights are converted into water shares, delivery rights and water-use licences; separation of water from land; creation of water share register
<i>Water (Governance) Act (Vic)</i>	2006	Mirroring of corporate principles in water governance
<i>Water Act (Cth)</i>	2007	Federalisation of water resource management; Formulation of Basin Plan

Table 1. summary of market based policy drivers

Victoria, Queensland, South Australia, the Australian Capital Territory and the Northern Territory (CoAG, 1995) operates on the premise that national productivity will be improved by the marketisation of water resources.

The adoption of market principles is broadly consistent with view across a number of developed nations that the state provision of services is marred by state failure. State-owned enterprises were targeted for reform taking a number of forms, including structural change by unbundling activities currently provided by monopoly bodies; commercialization, by requiring that an enterprise market its services on a commercial basis to achieve at least cost recovery; contracting out of functions; corporatization to establish the body on a fully commercial basis but as a state owned company, with a delineation of the roles of the Government and the entity; and privatization of the government owned business, either wholly or partly (Department of the Treasury, 1993).

In the United Kingdom privatization of water resources occurred under the Conservative Government in 1989, representing the largest and highest level of privatization in the world. Privatization has also occurred in the United States (Water Science and Technology Board, 2002). This prevalence of the view that the adoption of market principles in the provision of government services is a good thing takes in ‘a number of strands of economic thinking ... claims about the nature of organizational functioning and public policy-making’ (Walsh, 1995: 15) and the ‘ineffective’ and ‘inherently wasteful’ institutional framework implementing state activity and policy (Walsh, 1995: 15). Pusey notes the tendency of the dominant view to ‘see

the world in terms that neutralize and then reduce the norms of public policy to those of private enterprise' (Pusey, 1991: 8).

In Victoria there is a continuing reluctance to privatise water itself. The potential for a political backlash if such an attempt was made was recognised by the Victorian Parliament itself, when the *Victorian Constitution* was amended to prevent privatization of Victorian water authorities. The *Constitution (Water Authorities) Act 2003* (Vic) entrenches the responsibility of public authorities to continue to deliver water by the insertion of a new Part VII in the *Constitution Act 1975* (Vic). Section 97(1) states that if at any time on or after the commencement of section 5 of the *Constitution (Water Authorities) Act 2003* a public authority has responsibility for ensuring the delivery of a water service, that or another public authority must continue to have that responsibility. However, the section does not prevent the authority from contracting with another regarding the service, whilst retaining responsibility for it, and this has been a dominant mechanism in the provision of water services in Victoria.

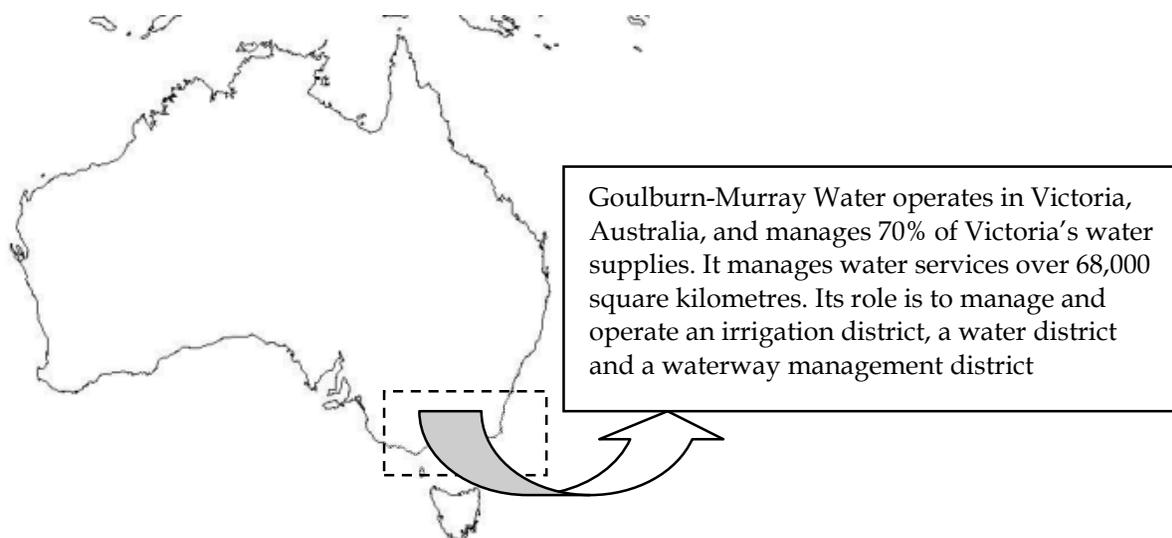


Fig. 1. Primary case study area

The situation in Victoria is a case study for the potential effects of irrigation trade in a geographically extensive, arid, aging, largely user-pays system. The area managed by Goulburn-Murray Water (<http://www.g-mwater.com.au/about/regionalmap>), is comprised of gravity irrigators, pumped irrigation systems, surface water diverters, groundwater irrigators, stock and domestic customers, commercial operators (such as tourism operators), and bulk water purchasers, such as urban water corporations.

The facilitation of trade in water in Victoria is a continuation of the National Competition Policy, driven by the Productivity Commission, and now overseen by the National Water Commission (the NWC), the Australian Competition and Consumer Commission (the ACCC) and the Essential Services Commission (the ESC). According to the National Water Commission, 'water trading is a centre piece of national water reform'.

The development of a national 'grid' to enable water trade is presumed to deliver a range of benefits:

- Enhancing the capacity to 'adjust' to changing agricultural circumstances, such as low commodity prices;
- Facilitating land use changes; for instance, purchasing more water to more fully utilise land, or selling water and converting to dryland farming;
- Enabling irrigators to 'hedge' against periods of poor rainfall by selling irrigation entitlements; for instance, in a period of prolonged drought some irrigators are able to convert to non irrigation operations, or to
- Liberating the embedded capital in a farming enterprise by enabling irrigators to sell or secure against their entitlement (separately from land);
- Enabling the transfer of water to urban use, thus adding economic value to regional communities;
- Improving the efficiency of water use by enabling water delivery to reflect market costs and encourage transfer to more efficient uses.

Water trading in major irrigation regions in Victoria can occur on a permanent or a temporary basis, and sophisticated methods have been devised to facilitate its occurrence. Water brokerage firms are common, and large water suppliers have user-interface systems which allow online trading of water. For instance, Goulburn-Murray Water developed the 'Watermove' web trading interface at www.watermove.com.au. It allows trade in water allocation, water shares, groundwater, and unregulated surface water. There is no doubt that water trading has, since its inception, provided significant flexibility for irrigators. During the recent decade-long drought water trading was particularly beneficial, and analysts of the effect of water trading have used these figures to illustrate its positive effect (National Water Commission, 2010a). A clear picture of the effects of water trade in an individual irrigation area is more problematic; consolidated records provide detailed information about the amount of water traded, whether it is permanent or temporary, high security or low security water, and the regions from or into which it was traded (National Water Commission, 2010b).

An indicative comparison of water traded in the Goulburn system in the height of the recent drought (2007 - 2010 irrigation seasons) demonstrates relatively flat net volumes traded (into the irrigation district) but high total volumes traded, demonstrating that water was moving between irrigators. It is possible to interpret this as a rational response to water shortage by those able to obtain a higher price per megalitre of water by selling it than they could by utilising it - particularly since overall water allocations may have been too low to continue normal farming operations. The fluctuations in temporary price are more indicative of the yield per megalitre of water, since purchase of permanent water in a given year would not necessarily deliver a full water allocation in that year.

Positive messages about the effect of water trade as a comparison to the alternative - water attached to land and unable to be traded - display some blindness to the historical position. Because of State government policies prior to the marketisation of water, irrigators were required to pay for water regardless of whether they received it or not. This was deliberate measure to ensure the ongoing viability of the irrigation infrastructure, and a lesson learned by government by the failure of private irrigation ventures during years of drought. Prior to 1986, during years of low allocation, irrigators could receive no water, but still be required to pay for that water. Conversely, if they did not need the water, but received an allocation, they were obliged to pay for it regardless. Thus, there was no incentive to conserve water,

severe impediments to changing land use, and ongoing costs in years of low income. The capacity to trade an allocation delivered immediate benefits. Irrigators whose land use was constrained by lack of water could improve the productivity of that land by purchasing additional water, and farmers who wished to transition out of farming, or transition out of irrigation farming, had additional mechanisms with which to do so.

Trading in the Goulburn 1A system 2007-11

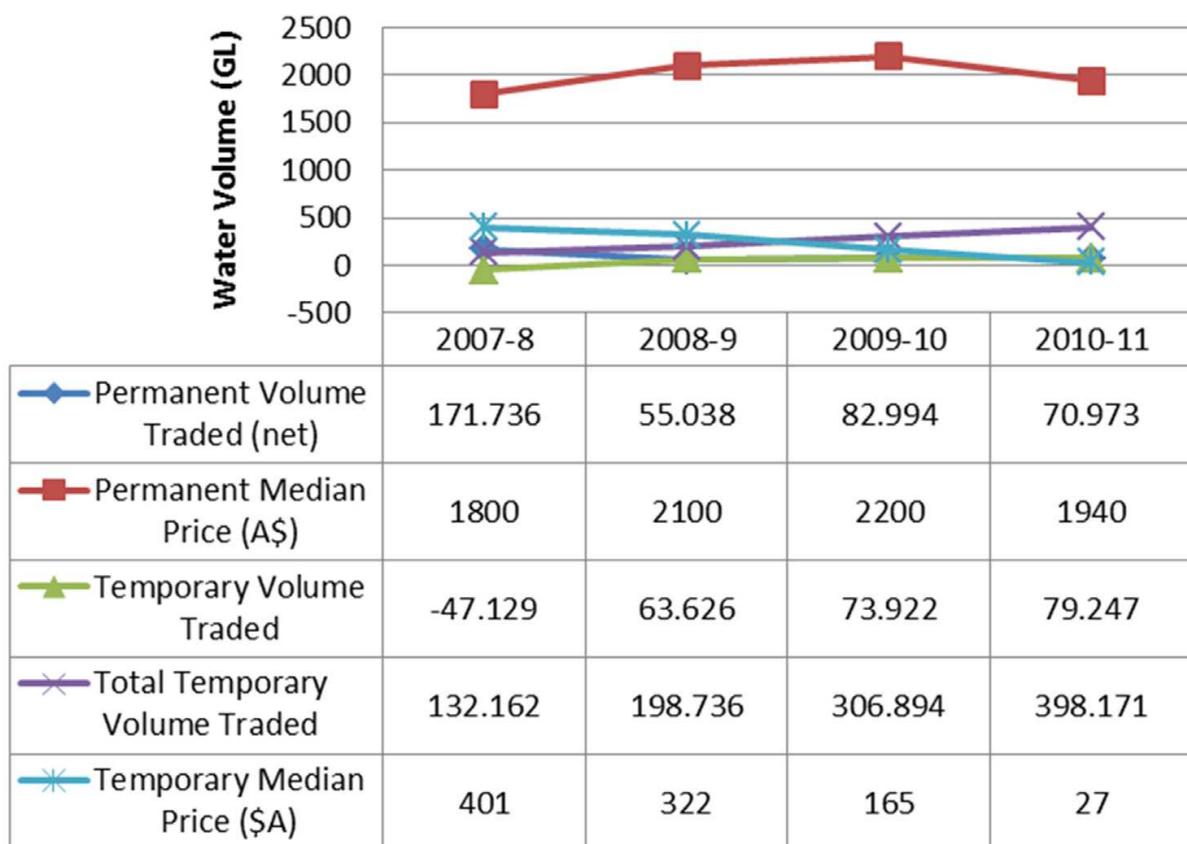


Table 2. Volumes traded in the Goulburn 1A Irrigation Zone.

However, marketisation of water was accompanied by a number of other mechanisms, including the unbundling of the water product into a number of products representing separate charges for delivery, infrastructure, and water components. The actual volume of water is not a major proportion of the bill. Thus, under the provisions of the *Water (Resource Management) Act 2005 (Vic)*, which amends the *Water Act 1989 (Vic)*, existing water rights were converted into water shares, delivery rights and water-use licences. The irrigator is able to trade the actual water share, but the infrastructure access fee would still be payable, unless the irrigator surrenders it. In order to surrender the access fee the irrigator has to pay a termination (exit) fee, which can be prohibitively expensive (ACCC, 2009b).

The purpose of the infrastructure access charges and the termination fees is to ensure the viability of the infrastructure in the event of significant numbers of water users exiting the water district. The obvious corollary to this is that, contrary to the principle of facilitating flexibility in land and water use, holders of large delivery shares are locked into irrigation

enterprises. There is the theoretical potential for people to trade the delivery share, however there is no market for that component. During the unbundling process irrigators with an existing right were given one delivery share for each hundred megalitre of water entitlement. However, the delivery share was devalued because irrigators requiring temporary water can acquire 270 megalitres on a parcel of land for each delivery share. There is, therefore, no market for the sale of delivery shares.

2.2 Environmental pressures

The environment is traditionally a matter within state Constitutional competence. State-based environmental legislation has a significant impact on the delivery of water in rural areas. Longstanding environmental measures at state level include those pursuant to the *Catchment and Land Protection Act 1994* (Vic), the *Environment Protection Act 1970* (Vic), the *Flora and Fauna Guarantee Act 1988* (Vic), the *Heritage Rivers Act 1992* (Vic) and the *Planning and Environment Act 1987* (Vic). Environmental requirements also apply under Part 3 of the *Water Act 1989* (Vic). Coverage by federal legislation has increased as a consequence of High Court interpretations of the external affairs power enabled by s.51(xxix) of the constitution, but significant co-operative measures had been taken to implement desirable environmental measures. In particular, the Murray Darling Basin Commission Cap was implemented to restrict diversions to 'the volume of water that would have been diverted under 1993/94 levels of Development. In unregulated rivers this Cap may be expressed as an end-of-valley flow regime' (MDBMC, 1996). The primary objectives of implementation were:

1. to maintain and, where appropriate, improve existing flow regimes in the waterways of the Murray-Darling Basin to protect and enhance the riverine environment; and
2. to achieve sustainable consumptive use by developing and managing Basin water resources to meet ecological, commercial and social needs.

As a consequence of the environmental stresses occasioned by the recent drought there has been a wholesale attempt to federalise basin-wide management of the water resource. The *Water Act 2007* (Cth), partially based on a patchwork of constitutional powers and partially a result of negotiations between the Commonwealth and each Basin State, was realised only when a drought of over a decade duration began to threaten urban water security. However, it had as its fundamental premise the desire to manage the Basin on a global basis, and in particular to limit extractions of water, in order to 'provide for the integrated management of the Basin water resources in a way that promotes the objects of [the *Water Act 2007* (Cth)], in particular by providing for:

- a. Giving effect to relevant international agreements (to the extent to which those agreements are relevant to the use and management of the Basin water resources); and
- b. The establishment and enforcement of environmentally sustainable limits on the quantities of surface water and ground water that may be taken from the Basin water resources (including by interception activities); and
- c. Basin-wide environmental objectives for water-dependent ecosystems of the Murray-Darling Basin and water quality and salinity objectives; and
- d. Water to reach its most productive use through the development of an efficient water trading regime across the Murray-Darling Basin; and

- e. Requirements that a water resource plan for a water resource plan area must meet if it is to be accredited or adopted under Division 2; and
- f. Improved water security for all uses [sic] of Basin water resources (*Water Act 2007* (Cth) s.20).

The Basin Plan has not yet been released; at the time of writing it had been delayed again until October 2011 (Slattery, 2011). Significant controversy has arisen over the appropriate balance to be struck between environmental, social and economic values in devising the Plan (ABC News 2010; Stubbs, Storer, Lux and Storer 2010). Whether the environment was to have priority in the final Basin Plan was a matter of competing legal views. There was a real question as to whether the Act required the Authority to privilege the environment over other concerns (Kildea and Williams, 2011). There are significant concerns as to whether the Authority is the appropriate body to balance social and economic factors with environmental concerns. The forwarding of social objectives is more properly left to political consideration. The *Guide to the Proposed Basin Plan* (MDBA, 2010a) prioritised the environment and required significant cuts to irrigation entitlements, but the negative response to the proposed plan (Cooper 2010; Lloyd, 2010a), however, and the return of rain (Lloyd 2010b) have delayed the progress of reforms.

2.3 Regional policy

Regional policy frequently demands political responses, and the vulnerability of policy-making which affects rural communities was demonstrated by the political fallout from the *Guide to the proposed Murray-Darling Basin Plan* (MDBA, 2010a). The priority for regional policy in Australia has, however, for many years, been the facilitation of 'sustainable' or 'resilient' communities, and the 'adjustment', with government assistance, of those that appear to be unsustainable. The government or quasi-governmental agency enables the individual or community to become a self-sufficient agent. Marketisation of water infrastructure and water resources is consistent with this view, since it conceptualises the individual as capable of utilising transactional mechanisms, such as contract, to achieve optimal personal outcomes. Full cost recovery on government supplied infrastructure, such as dams and channels, is necessary to ensure that the community is 'sustainable'. Trade in water ensures that water can move from an 'unsustainable' community to a sustainable one.

Analyses of the operation of market mechanisms for water transfer have been characterised as supporting this view; the National Water Commission, in a study of the effects of water trading in the southern Murray Darling Basin, concluded that 'water markets and trading are making a major contribution to the achievement of the NWI objective of optimising the economic, social and environmental value of water. The overwhelming conclusion of the study is that water trading has significantly benefited individuals and communities across the sMDB' (NWC, 2010, v).

The interaction between regional policy and the various water policies, however, is complex, particularly where the contraction of essential infrastructure is concerned. The basis upon which infrastructure - particularly water infrastructure - is reduced has far-reaching consequences for regions, since it affects rural rate bases, school and hospital viability, and a range of other services that depend on population density. The contraction of water infrastructure in the northern Victorian irrigation regions is driven by the decision that the

infrastructure is unsustainably expensive on a user-pays basis. As a generalisation this is problematic; there are elements of cross-subsidisation across irrigation districts in the larger water suppliers. Like all organisations the depreciation of infrastructure and the allocation of maintenance costs make a significant difference to whether the area is operating at a loss. Overall, the entirety of Goulburn-Murray Water is required to operate on a full-cost recovery basis (Standing Committee on Finance and Public Administration, 2007 - 2008). However, one of the consequences of modernisation of infrastructure will be an increase in the cost of that infrastructure for users on an ongoing basis.

3. Political, and environmental stressors

3.1 Water scarcity and centralisation of water policy

Thus, at the commencement of the new millennium Australian water policy was broadly consistent. However, the manner by which states implemented that policy, and the degree of compliance with key objectives, varied significantly. The more populous states of New South Wales and Victoria, with developed irrigation industries and a long history of appropriation, do not have the same interests as Queensland, with a shorter history of development and greater incentive to continue to allow diversions, or South Australia, with a capital city entirely dependent on extraction and a developing horticultural industry. Although compliance with national water policy is assessed, and Commonwealth tranche payments are dependent on that compliance, states' ability or willingness to set up the appropriate mechanisms has not always been evident. The Commonwealth suspended competition payments to SA, Victoria and NSW for not meeting their commitment to enable interstate trade in water by the agreed date of July 2006, and subsequently gained in-principle agreement to enable trade.

The decade of drought in the 1990s, however, allowed the federal government to assert significant political pressure on the states to centralise water resource management in the basin more thoroughly. Increasing pressure on urban supplies necessitated massive investments in infrastructure to ensure continuing supply of water to major population centres. The perennial state shortage of infrastructure funds for the construction of pipelines and desalination plants to augment city supplies was answered by federal government leverage of funding to obtain agreement to the referral of powers necessary to pass the federal *Water Act 2007* (Cth). The explanatory memorandum to the Act stated that it gives effect to a number of key elements of the Commonwealth Government's \$10.05 billion *National Plan for Water Security*. The Act is intended to enable water resources in the Murray-Darling Basin to be managed in the national interest, optimising environmental, economic and social outcomes.

The Act was contentious, and subject to constitutional challenge, particularly by the State of Victoria, which had initially refused to refer its powers to the Commonwealth. The Act in its final form commenced operation on 3 March 2008; however, as stated above, the Basin Plan required under the Act has not yet been finalised.

3.2 State policy and the rush for results

The availability of federal funding was a significant incentive, particularly for Victoria. However, the Victorian government would have suffered political backlash if it had simply

built a pipeline from rural water supplies and purchased water to augment urban supplies. Instead, it took the opportunity afforded by a proposal by rural interests to 'save' water by improving rural infrastructure, paying for it with a combination of urban, state and federal government money, and splitting the water 'saved' between the environment, urban water consumers and rural water consumers. Problematically, however, these decisions were made under the pressure of a drought, and urban water security, particularly in the capital city of Melbourne, was threatened. Thus there was significant pressure to find water 'savings' quickly, and expedite infrastructure development.

4. The 'modernisation' of irrigation infrastructure

4.1 Water savings and trade-offs

The major support for funding of infrastructure improvements is through identification of water 'savings' that can be deployed as environmental water or 'sold' to urban use. The trade metaphor enables consistency with the market-based premise within which the industry operates. Water 'savings' are generated through the replacement of meters, installation of regulators to enable closer regulation of the channel system to prevent outfall and reduce seepage (by running the channel lower) and in some cases through the lining or piping of channels. Leaving aside the highly questionable assumption of defective Dethridge wheels inevitably measuring in favour of farmers, for which significant savings have been claimed, the most significant water savings are generated through the privatisation or retirement of irrigation infrastructure.

The technologies of performance to monitor savings have, unfortunately, been preceded by the projects they are meant to be monitoring. Thus, audit of outcomes of the rationalisation processes has been performed without baseline data and the protocols for quantification of water savings had to be developed after the actions upon which the water savings were dependent had been commenced (DSE, 2010).

An early analysis of the use of water 'savings' mechanisms over other techniques was carried out by the Productivity Commission, which noted that

One of the purported benefits of water saving investment over market purchase is that it avoids reductions in rural water use by creating 'new' water. However, water 'savings' associated with indirect purchases can be illusory. That is, measures to reduce system losses actually divert water from other beneficial uses, elsewhere in the system, that rely on return flows (PC 2006b). For example, total channel control is a water delivery technology that uses automated control gates to reduce irrigation district outfalls and improve service quality. However, district outfalls often supply downstream water users. Transferring entitlements out of the system based on illusory water savings can therefore 'double up' losses in return flows (Productivity Commission, 2008: 78)

The Productivity Commission reviewed the operation of the NVIRP alongside other water purchase mechanisms to produce environmental flows - largely tender mechanisms - in 2009. However, consistent with the Commission mandate it was predicated on the use of market mechanisms to achieve the environmental outcomes and was primarily concerned with the interaction of proposed mechanisms (NVIRP, 2009).

4.2 Contraction of irrigation infrastructure

The Northern Victorian Irrigation Renewal Project (NVIRP) is a state-owned entity; the Chief Executive Officer reports through the NVIRP Board to the Minister for Water and the Treasurer. When the modernisation process is complete the assets constructed will be transferred to Goulburn-Murray Water. The aim of the 'modernisation' project now being implemented by NVIRP is to deliver 'a more efficient and affordable irrigation delivery network that is able to deliver an improved level of water delivery service and increase on-farm productivity' (DSE, 2004). Water 'savings' to be delivered from this program have been estimated as up to 425 GL annually. Of that amount, 75 GL were intended to be diverted to Melbourne, 175 allocated to the environment and 175 to irrigators in the system (King and Tonkin, 2009). The program was to have been partially funded by Melbourne Water premised on the diversion of water to Melbourne, but this was subsequently changed (Victoria Auditor General, 2009, vii). The 'Core Principles' of NVIRP, espoused by the Food Bowl Modernisation Project Steering Committee report and endorsed by the Victorian Government on 30 November 2007, are to:

- Focus on economic development
- Strive for efficiency in both water supply and farm watering systems
- Provide different levels of service to meet the needs of different customers and customer types
- Strive for an on-demand water delivery service
- Develop system components that ensure cost and service competitiveness in water supply
- Develop policies to support and guide decisions
- Stage project delivery to match funding availability (NVIRP, (nd b)).

The majority of these principles demonstrate the

'post-welfarist regime of the social' in which 'performance government' displaces the collectivist ethos of welfarism. Here, various state and non-state agencies become facilitators both in optimizing individual capacities to act in an entrepreneurial *and* socially responsible way, and in the diagnosis of potential risks that threaten to disrupt the achievement of personal liberty (Higgins and Lockie, 2002, 421).

The NVIRP not only reconstructs government infrastructure (on a user-pays basis) it will facilitate on-farm irrigation works, funding them with water off-sets, to enforce efficiency gains. Irrigators will inherit a high-functionality, high-cost irrigation network, and a fully marketised water trading system will enable the transfer of water from those unable to afford the higher water costs to higher value uses – such as urban use.

The irrigation area involved in the project is around 800,000 ha and 14,000 farms (Spencer, 2010: 17), and by any measure the injection of funds into the project is significant. Around \$2 billion is projected to be utilised in the project in replacement of meters, and regulators lining channels and implementation of 'total channel control' systems. 'Total Channel Control' is a Rubicon Systems product aiming for 'end-to-end irrigation canal automation technology ...[and] transforming the inefficient manually operated open canal networks into fully automated, integrated and remotely controlled systems that are achieving demonstrated new benchmark delivery efficiencies of up to 90%' (Spencer, 2010, 19). The

90% efficiency claim is substantiated by a reference to the Coleambally Irrigation district during the 2006-07 year (a drought year during which irrigators had a 10% irrigation allocation in that system) (DEWR, 2007) and refers to the claims that irrigators were allocated an extra 18% water allocation because of 'savings' from the new system; but it is not clear whether this is carryover from the previous year. It is not clear whether the 'benchmark' of 90% is an average or a measure on one channel in the system. It is being compared with the 73% *average* across irrigation systems. Losses will vary according to a range of factors including soil type, gradient, supply level and infrastructure age. Further, Coleambally was a greenfields site; the infrastructure was installed when the district was developed. Thus, it was new infrastructure, and the costs of retrofitting century-old infrastructure was not an issue.

Commentators have lauded the effects of the modernisation; the Business Development Manager of Rubicon Systems (which supplies the 'Flumegates' and 'Total Channel Control' mechanisms for the upgraded system), has reported that

A higher level of technological investment in the modernization of large unlined, gravity fed irrigation systems in the south-eastern state of Victoria has resulted in increases in efficiency from about 70% up to about 90% - a remarkable outcome. In Victoria, the water saved is being reallocated equally between urban and industrial users, the environment and to existing farmers to improve their security of supply (Spencer, 2010: 15).

Other commentators have been less laudatory; the cost of the infrastructure program in delivering environmental and urban water far exceeds the cost of purchasing the water on the market. Some irrigators are concerned not only about the projected contraction of the irrigation system, but also about the potentially unsustainable cost of the new technology, which will be likely to have a shorter lifespan than previous low-technology solutions such as the Dethridge Wheel, and will require them to bear higher ongoing infrastructure charges.

4.2.1 The backbone

The most significant factor in generating the savings required by the Northern Victorian Irrigation Renewal Program will be the contraction of irrigation infrastructure to the 'backbone'. This is the network of channels closest to the main carrier, based on the delivery share on that particular channel. Thus, modernisation works are being carried out to service those farms on the 'backbone'.

The contraction of irrigation infrastructure to the backbone was prefaced in the Victorian White Paper:

Rationalisation of services is primarily an issue for north-central Victoria. Goulburn-Murray Water and its water service committees realize that some parts of existing distribution systems need to be closed down. They were constructed in an era of bold development and in some places are just too spread out, as well as being on land that has turned out to be unsuited to irrigation (DSE, 2004: 82)

Rationalisation was originally a separate government program, but it appears that it has now been rolled over into the Northern Victorian Irrigation Renewal Program, resulting in difficulties ascertaining whether the objectives of either program had been met.

Rationalisation of irrigation infrastructure has not been confined to 'land that has turned out to be unsuited to irrigation.' The first irrigation district to be closed was the Campaspe Irrigation District, on excellent land and close to a natural carrier, and, ironically, flooded in early 2011 and in the following season water entitled to 100% allocation. The backbone becomes the de facto mechanism for limiting public funding of infrastructure. Those on the backbone undergo a series of consultation mechanisms to determine their current and future business needs – the farm irrigation assessment process – after which a decision is made by NVIRP as to their infrastructure requirements to meet those needs. The infrastructure will be installed and monetary compensation will be paid on the basis of assets removed. Additional programs utilising federal money and handled through the Department of Primary Industries finance on-farm efficiency works such as the installation of pipes and rises to replace flood irrigation, the piping of on-farm channels, and the laser levelling of land in return for the irrigator surrendering water. The agencies are therefore facilitating the projected business infrastructure requirements – they have taken on an enabling role, brokering deals to increase the efficiency of the irrigation operations of the farm.

4.2.2 The connection programs

The primary 'technology of agency' is the connections program, pursuant to which individuals or groups who are not on the backbone must negotiate either alone or with neighbours to connect to the backbone. NVIRP notes that

NVIRP's Connections Program involves connecting irrigators to a modernised main system of irrigation channels or 'backbone'. The program aims to consolidate supply point connections and ensure as many customers as possible are connected directly to the backbone to access improved water delivery services.

Properties are connected to the Goulburn-Murray Water channel supply system via supply point connections. Through the Connections Program, irrigators are being encouraged to upgrade their supply point connections or move supply points from secondary or spur channels to the backbone via a new connection, adopting the solution that best suits their farming operations (NVIRP, nd c).

This may mean that monetary incentives for connection are available based on water savings. Further incentives are available for on-farm efficiency works from programs like the Farm Water Program (Goulburn Broken Catchment Management Authority, 2010). NVIRP processes are mediated first by negotiation between one or a number of landowners, then by contract: a standard Rationalisation Agreement (NVIRP, nd a) forever discharges Goulburn-Murray Water and NVIRP 'from any and all claims and rights for any cost, loss, liability, damage, compensation or expense arising out of or in connection with the Rationalisation or the matters contemplated by this Agreement' (NVIRP, nd a: para 8(b)). Upon signature, the landowner accepts payment of compensation 'in full and final satisfaction of all claims...in connection with the matters contemplated by the Agreement' (NVIRP, nd a: para 7(b)).

The overall difficulty with the connections program at this stage, however, is the ongoing uncertainty for irrigators who have found themselves *off* the backbone, even though their farming enterprises are otherwise sustainable and profitable. Although the program rollout has occurred over a number of years, the lack of detail on the manner in which 'connections'

to the backbone will occur has been problematic, partly because it introduces the issue of the privatisation of infrastructure, and the risks and losses associated with infrastructure.

4.2.3 Privatisation of risks and losses

The perennial debate about the efficacy of 'market' mechanisms for the delivery of public services attracts the usual criticisms of wasteful government service provision (Brody, 2005: 3). Conversely, critics of market mechanisms as primary devices for delivery of social obligations instance failures in the market due to monopolization of private providers, failure to provide adequate incentives for delivery of social obligations and rising prices after privatisation of government services. Since instances of problematic introduction of market mechanisms can be dismissed where benchmarks for successful private delivery were insufficiently defined, and since reintroduction of full government provision of many services is not on the agenda, the debate must be more strategically defined.

The connections program brings public infrastructure to a single supply point. Although details have not been finally determined, the dominant model has been that water will be metered at that point. From that point, infrastructure requirements are privatised. Ongoing maintenance of that infrastructure is the obligation of the landowner or group of landowners. Additional infrastructure, such as road culverts and bridges, were also anticipated as included in private obligations, but local councils have expressed disquiet with that arrangement, and refused to accept applications for planning approval, and it has now been indicated that water authorities will be required to maintain responsibility for these assets.

If more than one landowner requires water from that single supply point, the administration of water from that supply point is also a matter for private negotiation. These arrangements are considered to be primarily of a commercial nature; decisions will be based on the current and projected irrigation business needs. This also privatizes losses on the infrastructure below the supply point, and enables NVIRP to claim these losses as part of the program savings. The expectation appears to be that contractual mechanisms will mediate relationships between affected irrigators.

Those not on the backbone continue to meet the other infrastructure demands of the system. Thus, landholders pay delivery share on the basis that they remain connected. Further, irrigators will be constrained from 'exiting' the system without the requirement to pay an exit fee. The ACCC oversees the obligation to pay an exit fee (ACCC, 2009a). The maximum termination fee allowed by the ACCC is 10 times the total infrastructure access fee (although a common requirement to pay the current year's infrastructure access fee makes it, in reality, 11 times that fee), which equates to the amount payable per delivery share. For many irrigators of average size, this amount will be in the hundreds of thousands, and it will vary between irrigation areas because the cost of maintenance of infrastructure will vary between areas. Ironically, those areas which have been most extensively modernised and thus have the most expensive infrastructure may also have the highest ongoing costs, and thus be the least sustainable. The issue of cross-subsidisation between modernised and unmodernised areas should now be closely monitored.

The ACCC notes that this arrangement may be varied by agreement, and NVIRP has indicated publicly that irrigators will be permitted to negotiate exit fees. However, where connections programs have not commenced this has not been an option.

Currently, as the details of the connections program have not yet been finalised, many irrigators are unsure whether connection back will be a viable alternative, as it will force irrigators to bear high infrastructure and maintenance costs and to reach negotiated positions with multiple irrigators without the statutory scaffolding available to authorities.

5. Conclusions

The political arguments through which the contraction of infrastructure has been made more palatable have been arguments for 'modernisation', efficiency, and the return of water to the environment. These have been most compelling during periods of water scarcity, and have been utilised to ensure that the grave political consequences of the failure of urban infrastructure have not eventuated. The processes through which modernisation have occurred have had the effect of privatising significant portions of infrastructure and transferring risk from the state to an individual or group of individuals.

There are significant risks in forwarding this strategy for regions. The increasing costs of maintaining a water supply, along with the potential to trade water to alleviate those costs, result in more and more water leaving irrigation districts. Since land with water produces more and can support greater numbers of people, the consequence of water leaving land tends to be an overall reduction in the economic wealth of the community and a reduction in the number of people in that community.

However,

The distribution effects of water trade depend on whether the people who sell the water stay in the region and whether they invest outside the region. The effects will also depend on whether those purchasing temporary allocations are doing so to offset their sale of entitlements, or whether those irrigators selling entitlements are different to those who are purchasing allocations.

The overall trend across GMW's main irrigation districts was a decline in the number of people employed in Agriculture, Forestry and Fishing ... by 5% between 1996 - 2001. (DSE, 2008).

The decline in rural populations is frequently considered to be an inevitable consequence of the economic conditions in first world countries, and concerns about food security (for instance, O'Grady 2011; Schmidhuber and Tubiello, 2007; Brown and Funk 2008), are alleviated by the argument that modern farming conditions, being more efficient, require fewer participants (c/f Altieri and Rosset, 2002). However, the consequence of the contraction of irrigation is an exacerbation of loss of population by a loss of infrastructure. This is a removal of both the industry and the capacity for the industry to continue.

6. Acknowledgements

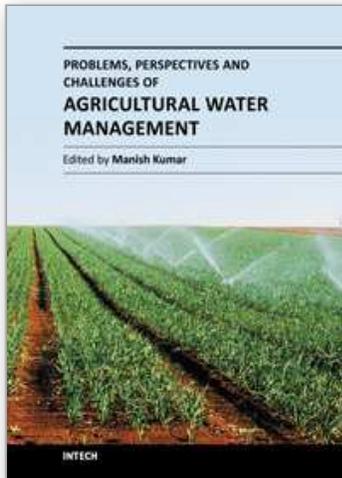
Figures in Table 2 are compiled from the Department of Sustainability and Environment, Victorian Water Register website at <http://waterregister.vic.gov.au/Public/Reports/WaterAllocation.aspx>

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Problems, Perspectives and Challenges of Agricultural Water Management

Edited by Dr. Manish Kumar

ISBN 978-953-51-0117-8

Hard cover, 456 pages

Publisher InTech

Published online 09, March, 2012

Published in print edition March, 2012

Food security emerged as an issue in the first decade of the 21st Century, questioning the sustainability of the human race, which is inevitably related directly to the agricultural water management that has multifaceted dimensions and requires interdisciplinary expertise in order to be dealt with. The purpose of this book is to bring together and integrate the subject matter that deals with the equity, profitability and irrigation water pricing; modelling, monitoring and assessment techniques; sustainable irrigation development and management, and strategies for irrigation water supply and conservation in a single text. The book is divided into four sections and is intended to be a comprehensive reference for students, professionals and researchers working on various aspects of agricultural water management. The book seeks its impact from the diverse nature of content revealing situations from different continents (Australia, USA, Asia, Europe and Africa). Various case studies have been discussed in the chapters to present a general scenario of the problem, perspective and challenges of irrigation water use.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Francine Rochford (2012). Rationalisation of Established Irrigation Systems: Policy and Pitfalls, Problems, Perspectives and Challenges of Agricultural Water Management, Dr. Manish Kumar (Ed.), ISBN: 978-953-51-0117-8, InTech, Available from: <http://www.intechopen.com/books/problems-perspectives-and-challenges-of-agricultural-water-management/rationalization-of-established-irrigation-systems-policy-and-pitfalls>

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