



**Environmental
Effectiveness and
Economic Efficiency
of Water Use in
Agriculture:
The Experience of
and Lessons from the
Australian Water
Reform Programme**



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**Environmental Effectiveness and
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The Experience of and Lessons from
the Australian Water Reform
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Note

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The other background reports (also available at www.oecd.org/water) are:

An Economic Analysis of the Virtual Water Concept in Relation to the Agri-food Sector
Dennis Wichelns, Hanover College, United States
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Executive Summary

Australia has embraced the idea of competition and markets as a paradigm for water management. Delivered through an emerging array of State and National initiatives. The result has been the generation of significant opportunities and wealth but, for a number of reasons, these gains have come at a cost to the environment. As a Nation, Australia is now moving to rectify the environmental problems caused by these reforms without losing access to the significant gains already achieved. With the resolution of these problems, it is expected that the development of water markets will be seen as the best way to have resolved the need to change the way water is allocated and used in Australia.

In this paper, Australian experiences and Australian approaches to water reform are summarised with a view to assisting countries to put in place water trading and other institutional arrangements without replicating the mistakes that Australia has made and is now having to rectify.

When Australia embarked on its water reform journey and the development of water markets, it focused on the development of fully specified entitlement and allocation announcement systems and the reduction of barriers to trade. Considerable effort has been put into the development of arrangements that reduce transaction costs and enable speedy adjustment and also promote efficient investment. Less effort was put into the resolution of an associated set of accounting and allocation issues that are critical for the maintainence of river health, wetland health and water quality.

One of the key recommendations made in the report is that water access licences or concessions as they are called in many countries should be unbundled so that access entitlements, seasonal allocations and use approvals can be managed using separate instruments and independent processes.

Lessons, challenges and recommendations identified in this report include the observations that

- Lesson 1: Unless carefully managed, the legacy of prior licensing decisions can result in markets causing over-allocation problems to emerge in a manner that erodes the health of rivers, aquifer and the water dependent ecosystems associated with them.*
- Lesson 2: Transaction and administrative costs are lower when entitlements are defined using a unit share structure and not as an entitlement to a volume of water.*
- Lesson 3: Market efficiency is improved by using separate structures to define entitlements, manage allocations and control the use of water.*
- Lesson 4: Early attention to the development of accurate licence registers is critical and a necessary precondition to the development of low-cost entitlement trading systems.*
- Lesson 5: Unless water market and allocation procedures allow unused water to be carried forward from year to year, trading may increase the severity of droughts.*
- Lesson 6: Early installation of meters and conversion from area based licences to a volumetric management system is a necessary precursor to the development of low cost allocation trading systems.*
- Lesson 7: It is difficult for communities to plan for an adverse climate shift and develop water sharing plans that deal adequately with a climatic shift to a drier regime. More robust planning and water entitlement systems are needed.*

- Lesson 8: The allocation regime for the provision of water necessary to maintain minimum flows, provide for conveyance and cover evaporative losses need to be more secure than that used to allocate water for environmental and other purposes.*
- Lesson 9: Unless all forms of water use are accounted for entitlement reliability will be eroded by expansion of un-metered uses like plantation forestry and farm dam development, increases in irrigation efficiency, etc and place the integrity of the allocation system at risk.*
- Lesson 10: Unless connected ground and surface water systems are managed as a single integrated resource, groundwater development will reduce the amount of water available that can be allocated to surface water users.*
- Lesson 11: Water use and investment will be more efficient if all users are exposed to at least the full lower bound cost and preferably the upper bound cost of supplying water to them. One way of achieving this outcome is to transferring ownership of the supply system to these users.*
- Lesson 12: Manage environmental externalities using separate instruments so that the costs of avoiding them are reflected in the costs of production and use in a manner that encourages water users to avoid creating them.*
- Lesson 13: Removal of administrative impediments to inter-regional trade and inter-state trade is difficult but necessary for the development of efficient water markets.*
- Lesson 14: Markets will be more efficient and the volume of trade greater if entitlements are allocated to individual users rather than to irrigator controlled water supply companies and cooperatives.*
- Lesson 15: Equity and fairness principles require careful attention to and discipline in the way that allocation decisions and policy changes are announced.*
- Lesson 16: Water markets are more effective when information about the prices being paid and offered is made available to all participants in a timely manner.*
- Lesson 17: Develop broking industry and avoid government involvement in the provision of water brokering services.*

Introduction

Australia, unlike many other nations, is a federation of States working under the constraints of a constitution that was finalised in 1901. Under section 100 of this Constitution responsibility for issues associated with water remains with States. Specifically, section 100 states that “The Commonwealth shall not, by any law or regulation of trade or commerce, abridge the right of a State or of the residents therein to the reasonable use of the waters of rivers for conservation or irrigation.”

As a result of the way this section of the Constitution has been interpreted, Australia’s National Government has not been able to dictate on water policy. This means that the processes used by the National Government to gain State acceptance of the need to change water management, arguably, have had to focus on ways to catalyse change.

Whilst, the Constitution leaves responsibility for water management with states, this has not proved to be a barrier to the negotiation of joint sharing agreements. Well known examples of such agreements include those in place for the management of Australia’s Great Artesian Basin, groundwater under the border between South Australia and Victoria and that negotiated for the Murray-Darling Basin.

A special agreement is also in place for the management of the Snowy River Hydro scheme¹ which, as well as generating hydro-power, diverts a considerable proportion of its flow inland to the River Murray and Murrumbidgee river systems.

The most well-known of the above agreements is that used to manage Australia’s Murray-Darling Basin. For many years, the rivers within this basin have been managed under a Murray-Darling Basin Agreement. In 2007, however, following widespread debate about difficulties in solving a host of over-allocation, water accounting and governance problems, the Commonwealth parliament passed a Water Act which following significant amendment in 2008, resulted in an agreement whereby all Basin-States referred their water planning powers to an independent Murray-Darling Basin Authority.

Negotiated in the late 1980s and agreed in 1994, notable features of the Water Act 2007 (as amended) and the Murray-Darling Basin Agreement that preceded include

- a limit or “Cap” on the quantity of water that may be diverted by any State in any year:
- the use of water markets to enable water use to move to places where it can make a greater contribution to the economy; and
- a market-based salinity management system.

Basin officials are quick to point out that the Cap has prevented states from issuing more water licences. Nevertheless, as a result of increases in water-use efficiencies and the development of groundwater, water use in the Murray-Darling Basin has expanded considerably² and the condition of the Murray River and its associated water dependent ecosystems has declined³ and there is now widespread recognition that the system is over-allocated. As a result and as foreshadowed in the Water Act, it has become clear that it will be necessary to manage all forms of water use with greater precision and, in particular, to manage un-metered uses of water including the impacts of plantation forestry, small farm dams, the capture of overland flows, reductions in return flows as a result of increases in irrigation efficiency and salinity interception. It has also become clear that the effects of increased groundwater use on river flow will need to be managed.

Legislative approaches

In all States, rights to use water are defined in legislation and managed through a variety of licensing and planning arrangements. Water is controlled by States and water users issued licences to use water.

Unlike the seniority entitlement systems used in much of the United States of America, most Australian water entitlement systems define pools of water that are shared in proportion to each person’s entitlement. Every season and depending upon availability, allocations are then made in proportion to the number of entitlements held. Under this pooling arrangement and as all entitlement holders have the same status (equal seniority), the costs of entitlement trading are much lower as there is no need to check to see if a trade would disadvantage other

entitlement holders. As a result, Australia has developed relatively low-cost water markets where willing irrigators can buy and sell entitlements and, also, buy and sell annual allocations with one another.⁴

As a result of reforms put in place over the last thirty or so years, nearly all area-based licences have converted into volumetric licences and nearly all water use is metered. Whilst most entitlements are still described in terms of an entitlement to a maximum volume, in practice, these are seen as an entitlement to the lesser of a share of available water and that amount.

There is now national agreement that a clear distinction should be made between entitlements and allocations and licences are being unbundled to facilitate separate management of entitlements, allocations and approvals to apply water to land. The National Water Initiative defines these components in the following manner

- **Water access entitlement** – a perpetual or ongoing entitlement to exclusive access to a share of water from a specified *consumptive pool* as defined in the relevant *water plan*.
- **Water allocation** – the specific volume of water allocated to water access entitlements in a given season, defined according to rules established in the relevant water plan.

(A fuller glossary of definitions and terms used in this paper is included as an appendix.)

Another significant difference between the Australian approach to water management and those used elsewhere, is the way decisions are made about how much water to set aside for system maintenance and for the environment. In Australia, the most common approach is to rely on water sharing plans, developed in consultation with stakeholders, to determine when and how water is allocated to users and how much should be put aside for system maintenance and environmental needs.

A typical water sharing plan, once approved by a State Minister, lasts for 10 to 15 years and is very difficult to change. The stated reason for this temporal fixity is that it is necessary to provide all consumptive water users with the investment security necessary to ensure efficient investment.

One other feature of Australian water entitlement and allocation regimes deserves special mention. Unlike the seniority regimes used in many other parts of the world, Australian water allocation regimes usually give equal seniority to all licences holders within a single or two defined pool. When two pools are used, the first pool is generally described as a high security pool and the second pool known as a general or low security pool. When water is scarce, water is allocated to the high security pool until each holder has received 100% of their volumetric entitlement and, once that has occurred, allocations are made to the second pool. The result is an allocation regime whose entitlements and allocations have a high degree of fungibility.

As a result of the above processes and features, the role of lawyers in formulating and changing allocation rules and in vetting entitlement trades is minimal. Security is offered by putting in place a regime that is supposed to stop erosion of entitlement reliability. The environment, however, is not given a formal entitlement and, as a result, when entitlement mis-specification occurs the main loser tends to be the environment. In an attempt to rectify this situation, Australia's National Water Initiative now requires that environmental water "be given statutory recognition and have at least the same degree of security as water access entitlements for *consumptive use* and be fully accounted for."⁵

At present, the term environmental water is used to describe both the water needed to cover evaporative losses from the system, conveyance losses and transfer obligations and, also, to describe that used in the periodic watering of wetlands etc. There is now emerging understanding that it may be wiser to describe this first category of water as maintenance water and only the second category as environmental water.⁶

Recent history of major reforms

One of the features that has driven water policy reform in Australia has been the development of water markets and water trading arrangements. Early approaches to the development of these markets drove change and structural adjustment but came at considerable cost to the environment and the value of the resource base as mistakes were made. This should not be taken as a criticism of those responsible for implementing the reforms. Rather, it should be seen as a consequence of the difficulties in implementing market-based reforms and a lack of knowledge about the ways that markets would function.

In retrospect, one of the most serious mistakes made has been a failure to begin by organising water entitlement and allocation arrangements in a manner that was designed to facilitate trade. Instead, most States simply super-imposed trading arrangements upon existing licensing arrangements.

In retrospect, it has become clear that in surface and groundwater systems where water entitlements and allocations are not tradeable, it is usual for a significant proportion of the entitlements under issue not to be used. Reasons for non-use of an entitlement include holding a reserve droughts and, in the future, to develop more irrigation. There are many other reasons. When trading is introduced, however, water increases in value and, given the opportunity to sell unused water, many people decide to do this, with the result that over-allocation problems can emerge. Over-allocation is a state of a resource where the sum of all entitlements and their nominal allocation is greater than the amount of water that can be used without causing a decline in river and aquifer health. The solution to the problem is either to reduce allocations per entitlement or to increase water use to unsustainable levels and, for a period of time, over-exploit the system. Australia is now wrestling with the complexities of dealing with over-allocation problems that resulted from a failure to address and resolve this issue as it developed its water markets.

National reforms

Arguably, one of the most significant water policy achievements in recent times has been the negotiation of a Murray-Darling Basin Agreement during the late 1980s and the finalisation of the legal arrangements necessary to bring it fully into effect in 1994. Whilst efforts are now underway to replace the resultant structure with a new one, the form of this Agreement is regarded as a significant achievement. A new Murray-Darling Basin Commission was established and a large number of reforms put in place.

One of the most significant achievements under the Murray-Darling Agreement was the establishment of a volumetric limit on the amount of water that could be diverted by any State in any year. Once it became clear that this limit on diversions was to be implemented by all States and, in particular, no new diversion licences would be issued, attention moved to the use of competitive processes to improve water use. Compliance with this limit, or “Cap” as it is called, is independently audited.

In parallel with the introduction of a limit on the amount of water that could be diverted by States, in 1994, Australia also introduced a *National Competition Policy*. From a water policy perspective this new initiative required

- The development of water markets as a means to improve the efficiency of water use;
- The separation of water supply institutions from water policy development and enforcement; and
- The introduction of full cost pricing for the delivery of water with full cost defined to include the cost of externalities

Under the National Competition policy milestones of implementation of each of the above reforms was set and it was agreed that the transfer of significant amounts of money from the National Government to State Governments would be conditional upon the completion of agreed milestones. Penalties for non-delivery were significant and, in one instance, amounted to AUD 24 million.⁷ Driven by the financial need to have access to this money, States began implementing a raft of policy reforms which, otherwise, would have been difficult to implement.

In retrospect, it must be concluded that many of the water allocation arrangements and agreements upon which the National Competition Policy water reforms were implemented were seriously flawed. In particular, water entitlement registers were not well developed, entitlements were rarely defined in a manner that was consistent with the behavior of the resource, tenure arrangements were uncertain, climate change risks were not well assigned, ground and surface water resources tended to be managed as if they were never connected with one another, and the effects of farm dams, forestry and other forms of water interception were not being accounted for. In response to this situation in 2003, the Australian Governments committed to a *National Water Initiative* and established a National Water Commission to ensure that the Initiative remained on track.⁸ Water reform processes of the type that Australia has embarked on are probably best seen as an extremely worthwhile journey that involves many learnings and many challenges that need to be resolved.

- Under the National Water Initiative, significant financial incentives were offered to States in an attempt to convince them to agree to implement the water policy reforms necessary to achieve agreed National Water Initiative outcomes. Key National Water Initiatives included requirements for State and Territory governments to unbundle water access entitlements from use approvals and formalise water sharing and allocation in a manner that would improve investment security;
- Develop water markets and remove impediments to low cost trading in entitlements and in allocations;
- Improve water pricing and charging arrangements;
- Resolve over-allocation problems and improve environmental management arrangements including providing entitlements for the environment and establishing environmental watering plans; and
- Improve water accounting arrangements and, in particular, begin managing connected ground and surface water bodies as a single integrated resource.

To this day, the National Water Initiative continues to be regarded, at an international level, as one of the best statements of what governments should seek to achieve in water policy. Arguably, the National Water Initiative's main weakness was its separation from the National Competition policy framework. In particular, it was agreed that money would no longer be withheld from State and Territory governments if they failed to meet agreed National Water Initiative milestones.

Worsening climatic conditions in eastern and southern Australia, coupled with difficulties in resolving over-allocation and administrative weaknesses in the Murray-Darling Basin led the Prime Minister to announce a ***National Plan for Water Security*** that, initially proposed a national take-over of water management in the Murray-Darling Basin with a view to enabling its management as a single inter-connected ground and surface water resource. Subsequent negotiations with States resulted in the passing of a new Commonwealth Water Act enabling the Commonwealth to take a greater role in the management of the Basin. Further negotiations and change in government at the National level produced further legislative changes and an agreement with States that has resulted in the transfer of planning powers to an independent expertise-based Murray-Darling Basin Authority (which replaced the Murray-Darling Basin Ministerial Council) that is responsible for developing a new Basin plan under the general direction of the Commonwealth Minister for Water. This new arrangement which is being implemented through a program known as ***Water for the Future*** includes

- An allocation of AUD 3.1 billion over ten years to enable the Commonwealth Government to buy water entitlements for the environment; and
- AUD 5.8 billion for investments designed to improve irrigation efficiencies and through this yield water savings to be shared between irrigators and the environment.

All water entitlements secured for the environment under this program (Water for the Future) will be held and managed by a Commonwealth Environmental Water Holder. In addition, it has been decided that the Murray-Darling Basin Authority will report directly to the Federal Minister. The MDB Council, together with Basin Officials, constitute the forums through which the Minister consults State Ministers and Senior Officials about water planning in the Basin.

Throughout the last decade, it has become increasingly clear to all that the cost of not resolving so-called over-allocation and over-use problems has risen dramatically.⁹ The southern connected part of the Murray-Darling Basin is now recognised as experiencing a crisis – partly as a result of a regime that has not prepared it for a dramatic reduction in inflows and partly as a result of mis-management of a number of key challenges. It is hoped that the new Basin Plan for the Murray-Darling Basin coupled with the purchase of water entitlements and the investments in increased water use efficiency will resolve this problem.

In parallel with these reforms and in order to resolve questions associated with the operation of the market and in particular the maintenance of competitive neutrality in the supply of water to irrigators and investment in infrastructure, the Australian Competition and Consumer Council (ACCC) has been made responsible for establishing the rules associated with charges for access to water supply infrastructure and the supply of water to users. Under this new arrangement, the ACCC will seek to:

- “promote the economically efficient and sustainable use of water resources and water infrastructure assets;
- ensure that operators receive sufficient revenue to provide the required services;
- facilitate efficient water markets;
- give effect to the principles of user-pays;
- achieve pricing transparency;
- avoid perverse or unintended outcomes;
- encourage full cost recovery; and
- ensure consistency in charging where entitlements are able to be traded.”¹⁰

Parallel State responses

At the State level, the requirement for State and Territory governments to either implement reforms or forgo competition payments led to many reforms. One of the most obvious indicators of the extent to which this has happened is the fact that every State has chosen to prepare a new water act. Significant reforms that States implemented in the 10 years between the decision to implement the National Competition policy and establishment of the National Water Initiative include

- The separation of government policy making processes from the business of maintaining water supply infrastructure and supply water to users;
- A move towards full cost pricing in both urban and rural areas to the extent that there is now almost total recovery of operating costs from users (but there still a need to recover water planning costs, the need for a return on the capital invested in infrastructure and to find a way to signal the costs of many externalities¹¹);
- The preparation of legally binding water sharing plans designed to clarify the conditions under which water is allocated to the environment and to consumptive users, to clearly assign supply risks and to encourage investment;
- The fuller specification of water entitlements and in particular the separation of these entitlements and allocations from land titles in a manner that facilitates trade;
- The unbundling of water entitlements and the allocations made to them so that either can be traded more efficiently; and
- The development of water markets and a water brokering industry.

In its first biennial assessment of progress, the National Water Commission has observed that “governments have made significant progress” but that “... adapting to future water management challenges requires more work to improve and accelerate the implementation of NWI reforms, particularly in the following areas:

- reduce the over-allocation of water resources;
- determine groundwater and surface water connectivity;
- account for the interception of water from land use change;
- provide for the integrated management of environmental water; and

- improve water accounting, measurement and compliance.” (NWC 2007).¹²

Expressing the same ideas in different terms, in a March 2008 report to the Council of Australian Governments prepared by officials on water reform progress observed that “...in the face of a drying climate in a number of parts of Australia, and increased demand, the following significant challenges remain:

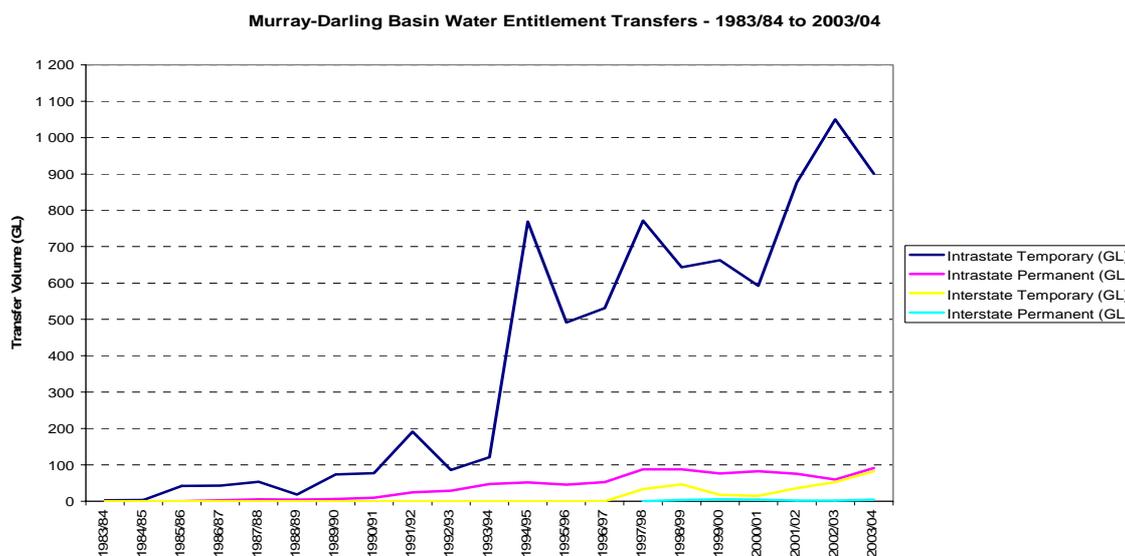
- too much water is being extracted from rivers and aquifers in many areas, and as a result, river health is continuing to decline; and
- rural water markets are not working as effectively as they might to help adjust to an environment of reduced water availability” (CoAG 2008b).

The remainder of this report focuses on Australian experience and the lessons that Australia has learned as it implemented water reforms in rural areas. The report is underpinned by the observation that in recent years and as a result of an extended drought, most rural areas have experienced a massive decline in the volume of water available for environmental as well as consumptive purposes. One of the advantages of a critical widespread water shortage is that it focuses the attention of managers on quantity issues and reveals the extent of existing problems and areas where policies may need to be changed.

Benefits and costs of the reform process

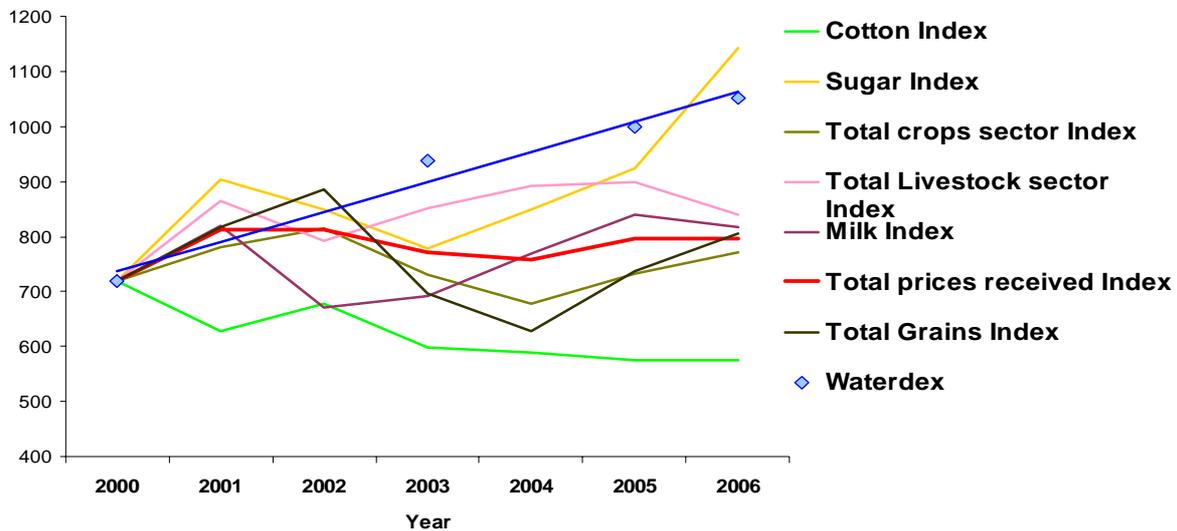
Driven by increasing water scarcity and government commitments to stop the expansion of total water use in areas where water resources are fully developed, Australia has witnessed rapid investment in new forms of water use and a dramatic increase in productivity per unit of water used. In the 10 years between 1990/02 and 2001/03, Australian water use per hectare halved (OECD 2008). Moreover, all objective assessments have found very positive returns to the development of water trading at both the national and regional level (see for example, Young *et al.* 2007; Frontier Economics 2007). For many irrigators, water allocation trading has become a common practice – especially in times of water shortage. Entitlement trading has also become a well established practice particularly in the Murray-Darling Basin (Figure 1). The value of water entitlements has increased significantly (Figure 2).

Figure 1. Growth in water trading in the Southern Connected portion of the Murray-Darling Basin 1983 to 2004



Source: Murrumbidgee Irrigation, personal communication.

Figure 2. Relationship between long-run national water entitlement price index (Waterdex) and indices of the value of agricultural commodities developed by the Australian Bureau of Agricultural Economics



Source: Psi-Delta, Available HTTP: www.psidelta.com/waterdex.html. (Accessed 13 January 2008.)

The benefits of the above reforms have been considerable and, in particular, have dramatically reduced the impacts of the drought and induced considerable innovation. The main problems have been associated with convincing all governments involved to fully implement the reforms in a timely manner. As water prices have risen and scarcity become more acute, it has become increasingly difficult for water managers and Ministers to find a way to fix over-allocation problems. Deliberating on this reality, the National Water Commission in the biennial assessment mentioned earlier reported that

“... The Commission considers that the NWI outcomes for integrated management of environmental water for the environment are not yet being achieved.

The Commission has concerns about whether environmental managers have been clearly established, have clear authority (both statutory and in terms of community recognition and acceptance) and sufficient financial and technical capacity to enable them to perform the role envisaged for them under the NWI.

Most States do not have an independent audit of environmental outcomes as required by the NWI. Such audits are important to building public confidence in the delivery of environmental outcomes.

Improved river health and groundwater monitoring and incorporation of that information in the adaptive management of water resources are significant challenges that are beginning to receive attention in many States.

The Commission considers a more harmonised national approach is required and has developed and made available the Australian Water Resources Framework for Assessing River and Wetland Health.

The multiplicity of programmes and mechanisms for recovering water for the environment —especially in the MDB — is potentially inefficient.”

With regard to the last National Water Commission observation about mechanisms for recovering water for the environment, whilst a number of mechanisms are being trialed, the amounts of water actually secured represent a very small proportion of the amount that objective assessments suggest needs to be secured. In the Southern Connected River Murray System, for example, the amount needed is generally thought to be greater than 1,500 GL plus the adverse effects of interception processes that are thought to be of a similar magnitude. Whilst under a Living Murray Program which set out to secure 500 GL of water for the environment by 30 June 2009 the actual amount secured since the programme was put in place in 2002 is 168 GL, leaving 332 GL of water entitlements to be secured in four months from programs that are “ready to be implemented.”¹³

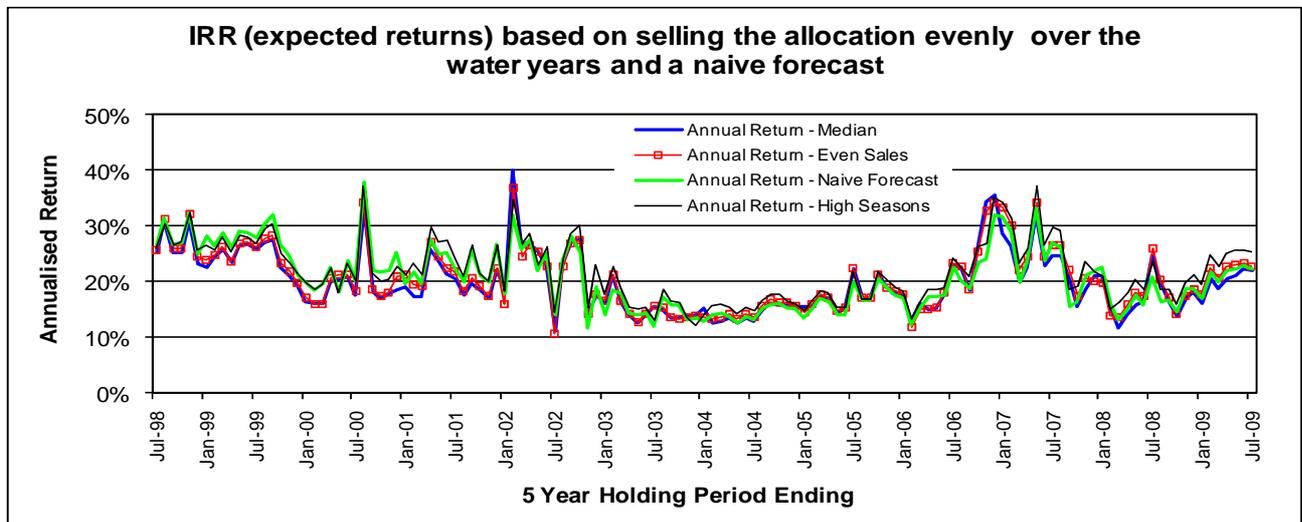
In parallel with these initiatives, under the new administrative arrangements described above as of May 2009, the Commonwealth Environmental Water Holder has secured 7.1 GL of high security water entitlements and 7.8 GL of general and low security water for use by environmental managers in the Southern Connected River Murray System.¹⁴ Most recently and as part of a very large purchase from one agricultural company, in June 2008, the Commonwealth was able to purchase 47.6 GL of general security water entitlements and 20.8 GL of supplementary water entitlements in the Southern Connected River Murray System.¹⁵

Finally, despite the presence of unresolved problems and challenges, water market data continue to express confidence. National indices of the value of water entitlements show that the return from holding a water entitlement exceeds the performance of related agricultural assets. Water market data also shows that investors in water have been able to make returns will in excess of 15% per annum (see Figures 3 and 4).¹⁶

Major challenges and lessons to be learned

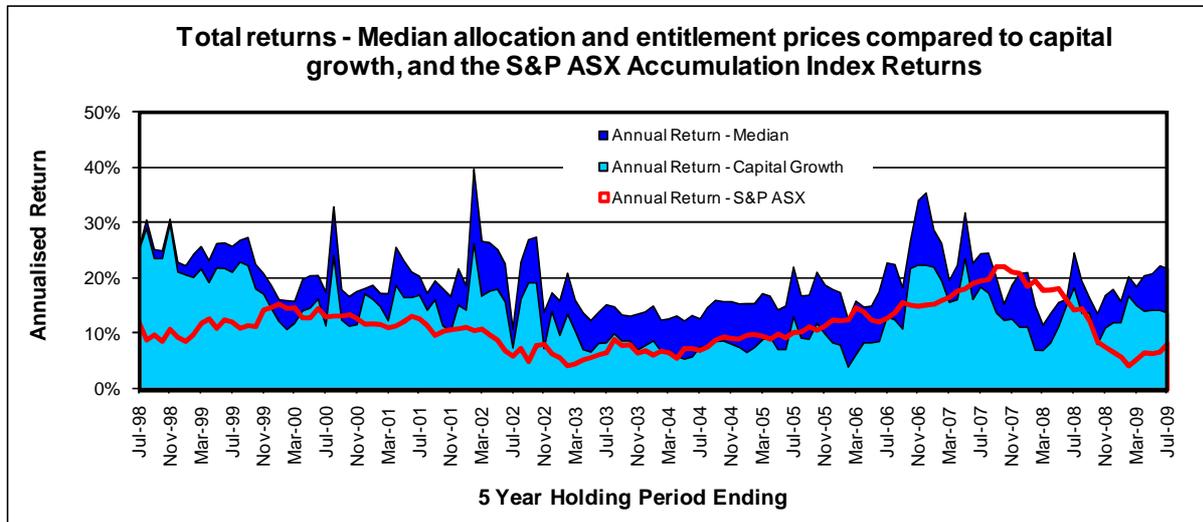
Rather than reporting further on progress made in implementing water reforms in the midst of increasing water scarcity, the remainder of this report focuses on the challenges and lessons learned by Australia as it has tried to bring increasing market discipline into the arena of water allocation and management.

Figure 3. Internal rate of return from selling allocations evenly under different selling strategies



Source: Bjornlund, H. and Rossini, P. (2010) Climate Change, water scarcity and water markets - Implications for farmers’ wealth and farm succession. Paper presented to 16th Pacific Rim Real Estate Society Conference, Wellington, New Zealand, January 2010

Figure 4. Annual returns from selling allocations (dark blue) and capital growth (light blue) in the value of a water entitlement compared with an index of the value of shares in the Australian Stock Exchange, Goulburn Murray System, Murray-Darling Basin's



Source: See Figure 3.

Underpinning the Australian experience is a suite of institutional and property right arrangements that have made it easier to set up viable water markets than is the case in many other countries. The general model is one that has involved development of a regime that has not allowed people to own water as an absolute right. Instead, legislation makes it abundantly clear that States have a right to control water use and that water users may only acquire or hold an entitlement to use water that is made available for use. Moreover, it is the role of government rather than the courts to determine how much water is available for use. States are also empowered to regulate the capture of overland flows, all rivers and all groundwater. The result is a property right regime that is conducive to the development of efficient markets. Where countries still have the choice, it is recommended that they adopt a similar regime. Core elements include

- The specification of *entitlements* to water as an entitlement to be treated equitably to a share of allocations made to defined pools of water; and
- The practice of periodically defining how much water has been granted to each user as an *allocation* that may be taken within a specific time frame.

Lessons and challenges associated with the design and configuration of entitlement regimes

Lesson 1. Unless carefully managed, the legacy of prior licensing decisions can result in markets causing over-allocation problems to emerge in a manner that erodes the health of rivers, aquifer and the water dependent ecosystems associated with them.

Arguably, one of the greatest challenges associated with the introduction of water trading is the question of how to deal with the fact that, when water entitlements are not tradeable, users tend to hold entitlements to more water than they use. When a limit is placed on the total amount of water that may be diverted and trading allowed, irrigators seek either

- a) to activate these unused entitlements; and/or
- b) sell these entitlements to someone else. In an under-allocated system, the activation of this sleeper or dozer water – as it is called in Australia – is not a problem.

If the number of entitlements exceeds the capacity of the system to supply it, then over-allocation results in over-use – unless allocations per entitlement are reduced as fast as people choose to activate previously unused entitlements.

Australian experience with management of the many complex wealth distribution issues associated with the tendency of markets to activate unused water entitlements reveals that it is very difficult to find a way to resolve this issue to the satisfaction of all. Pro-rata reduction of every-one's entitlement is seen as unfair by those who are already using all their entitlement and then have to buy back water to maintain productivity. At the same time, those who have not yet used or developed their entitlement object to any concept that any or all of this water will be retired. In retrospect, the golden rule is that *governments should never issue more entitlements than there is capacity in the system, always keep the sum of all entitlements in line with system capacity and make it clear to all what will happen when un-used water is activated*. Unfortunately, many Australian States failed to do this and, as a result, many communities and many people have experienced unnecessary hardships whilst governments searched for fair ways to resolve the problem.

The next few lessons focus on the design and specification of water rights in a manner that makes the development of sophisticated water markets easier. The focus is on lowering transaction costs faced by buyers and sellers and, also, on reducing *administrative* costs.

Lesson 2. Transaction and administrative costs are lower when entitlements are defined using a unit share structure and not as an entitlement to a volume of water.

As recommended in Australia's National Water Initiative and as now practised in several States, *one of the simplest ways of preventing over-allocation problems from emerging is to assign the risks of adverse climate change and/or the emergence of long dry periods to entitlement holders and define entitlements as an entitlement to a share of the water defined as being available for use*.

For many years, Australian water entitlements were defined using a volumetric description of the maximum amount that would be allocated. More recently, however, States have started defining and referring to entitlements as shares. Whilst both mathematically and in law there is no difference between these two approaches, the choice of words makes it clear that entitlement ownership involves risk. The result is a much clearer understanding of the risks associated with holding an entitlement and, because of this, much more efficient investment.

A related issue is the question of whether or not entitlements are better defined as a single holding as is done with land titles or using a unit structure similar to that used to define ownership in a limited liability company share register. As a general recommendation, *entitlements should be defined using a unit share structure and never using a proportional share structure*. When a unit share structure is used any number of shares can be sold without having to first subdivide the holding. Under a unit share structure, the costs of changing a system boundary are less as one only needs to deal with the shares that move from one system to another. If a proportional, rather than a unit share structure is used to define an entitlement then the cost of revising or subdividing system boundaries is prohibitively expensive as every single share must be redefined.

Lesson 3. Market efficiency is improved by using separate structures to define entitlements, manage allocations and control the use of water.

Markets operate best when they involve many entitlement holders and cover a large area with diverse water supply needs. As a result, there is benefit in maximising the size of each pool of water managed under a single system. When Australia first issued water licences, they were issued in a manner that bundled together local use conditions with definitions of the extent of the entitlement and the rules as to how much water could be taken in any period. As part of the process of deepening water markets and also to allow independent management of local and system-wide issues that operate at different scales, Australia has nearly completed the process of unbundling its water licences and replacing traditional water licences with separate water entitlements and use approvals. The result, in its simplest form is a three part structure.

- The **entitlement** is to a share of any volume of water allocated to a defined management pool. One example of a pool of water is all the water available for consumptive use and presently held in a large storage dam. This entitlement is separated from its land title.
- When a **volumetric allocation** is made to an entitlement, these allocations are recorded in water accounts associated with the entitlement. Allocation trades, or temporary trades as they are called in Australia, can then be made by debiting one account and crediting another. Allocations may be applied on any area of land that has a use approval.

- The content of a typical **use approval** is then restricted to rules for applying water to a nominated area of land and deducting the amount used from a water account associated with the use approval.

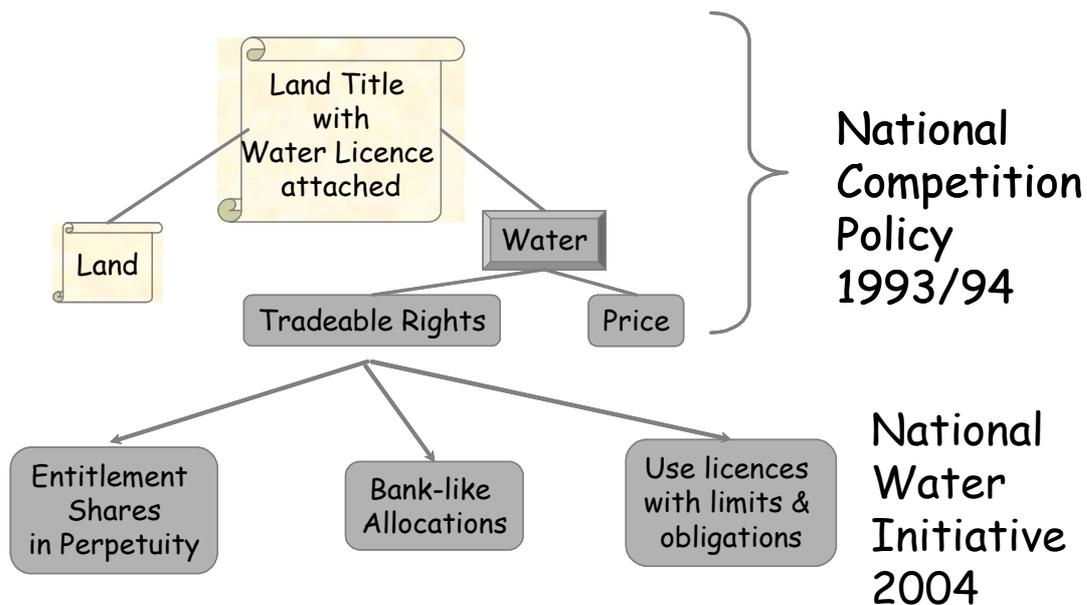
By unbundling licenses into separate allocation and management instruments, the costs of managing water use are reduced and opportunities to trade increased significantly.

One of the main reasons for unbundling water licences is that it separates the management of system wide issues from local issues, because of variations in topography and soil type need to be managed at the local level.

In some but not all systems, the water in dam storage is partitioned into two pools: a high security pool and a general or low security pool. Allocations are then distributed on a preferential basis to those who hold high security entitlements. Allocations to general security or low security pools are made after high security users have received their entitlement. The larger the size of the high security pool, the more variable allocations to the general or low security pool. As the costs of trading and allocation are reduced and as the time taken to execute the trade is decreased the case for issuing two rather than one type of entitlement decreases.

In regimes where entitlement holders are allowed to carry forward unused allocations from one year to the next, the normal practice is to only have one type of entitlement as water users can manage inter-seasonal risk by carrying forward rather than selling unused water that has been allocated to them.

Figure 5. Evolution of water reform in Australia and the progressive separation of water licences from land and their subsequent unbundling into separate components



Source: After Young and McColl (2005).

Lesson 4. Early attention to the development of accurate licence registers is critical and a necessary precondition to the development of low-cost entitlement trading regimes.

In the early stages of the development of irrigation in Australia, water licences rather than formal entitlements were issued to irrigators. Moreover, as water licences were linked to land titles, and as they were not seen as instruments of value that might become valuable in their own right, little effort was put into maintenance of the integrity of licence registers and, in particular, to the selection of the names of the people to whom the licence was being issued to. With the introduction of trading, however, the function of water licence registers changed and they became formal registers of property ownership. Once this happens, any changes to a register need to be undertaken with great care and only through due process.

In retrospect, Australia has learned, at considerable cost, that the initial processes used to issue water licences lacked the registry disciplines to enable trades to be executed without first having to go back and carefully check who really owned the water entitlement being sold. This situation came about because as licences were linked to land titles, some states considered it necessary only to record the name of the person who applied for the licence and not the names of all the people who had an interest in the land associated with it. Whilst sufficient for the issue of a non-tradeable licence, this practice meant that water managers had to be very careful to ensure that they did not approve the sale of a water entitlement without the consent of all parties who had an interest in it. As a result and once trading became normal practice, all licence registers had to be verified.¹⁷

Register verification involves requires careful attention to detail and to administrative process. It is a costly and time consuming process. In retrospect, most Australian water administrators would recommend that water licence registers be constructed in the expectation that they will become independent registers of ownership.

As noted earlier, Australia has also learned that it is wiser to issue unit shares rather than proportional shares as this approach enables the transfer of shares from one water management regime to another without having to amend the entire register.

A related issue is that of register compatibility. To date, every Australian jurisdiction has built its own water entitlement registry and, in areas where water bodies pass through more than one State considerable effort is being invested in a programme that is designed to increase the capacity of all registers to interact with one another. Australia is experiencing immense difficulty in connecting these registers with one another, so that at any point in time any entry in a register can be described as a completely accurate description of who is the registered owner of an entitlement.¹⁸ Administrators are also finding it difficult to establish reliable low cost water allocation accounting systems. In state of the art systems, allocation trades are executed by simultaneously debiting one account and crediting another and entitlement trades are executed by changing the name recorded on the register. *For each system, it is only necessary to have one entitlement register.*

In a complex suite of administrative arrangements, Murray-Darling Basin States have recently begun registering tagged trades that involve the linking of registers. As described in the National Water Initiative, **water tagging** is an accounting mechanism that allows a traded *water access entitlement* to retain its original characteristics when traded to a new jurisdiction and/or trading zone, rather than being converted into a form issued in the new jurisdiction and/or trading zone. The alternative and administratively simpler approach is to manage all under a single integrated rather than connected registry system.

Lesson 5. Unless water market and allocation procedures allow unused water to be carried forward from year to year, trading may increase the severity of droughts.

One of the main reasons for developing a water market is that it sets in train a series of processes that optimise water use. For water use to be optimal, however, it is necessary that water users also be given the opportunity to optimise water use between as well as within seasons. One of the more serious mistakes in the Southern Connected River Murray system was to only allow irrigators to trade unused allocations within a season and, at the end of the year, cancel any unused water entitlements. The result is a regime that encouraged water users to sell or use water that would have most profitably been saved for use in another year. The result, if unused water cannot be carried forward was a process that tended to draw down supplies too quickly and increase supply variability, so much so, that studies have revealed that all the gains from trade can be lost by worsening the impact of droughts.¹⁹ *The solution to this tendency for within season trading to deepen the impact of droughts is to allow irrigators to choose between leaving unused water on their account, with an adjustment for evaporation losses, or sell it.* In recognition of the costs of not allowing the water market to have a say in how much water is carried forward from year to year, States have been trialling the introduction of arrangements that allow water users to carry-forward unused water allocations from one year to the next. The result is an efficient trading regime that enables water users to manage inter-seasonal risk in a manner that is optimal for them. In recognition of the benefits of allowing water users to

manage inter-temporal risk, some Queensland systems have been converted into what is called a continuous accounting or dam capacity sharing system. Under these regimes, adjustment for storage losses, etc is continuous and users are free to decide when they take their water.

In continuous accounting systems, such as those used in Queensland, administrators are responsible for allocating inflows into storages. In systems that do not do this, plans are used to determine how much is left in storage and how much should be allocated to entitlement holders. In some continuous accounting systems it is necessary to establish delivery entitlements and establish rules for managing spills.

Lessons and challenges associated with system-wide planning, management and governance arrangements

Lesson 6. Early installation of meters and conversion from area based licences to a volumetric management system is a necessary precursor to the development of low cost allocation trading systems.

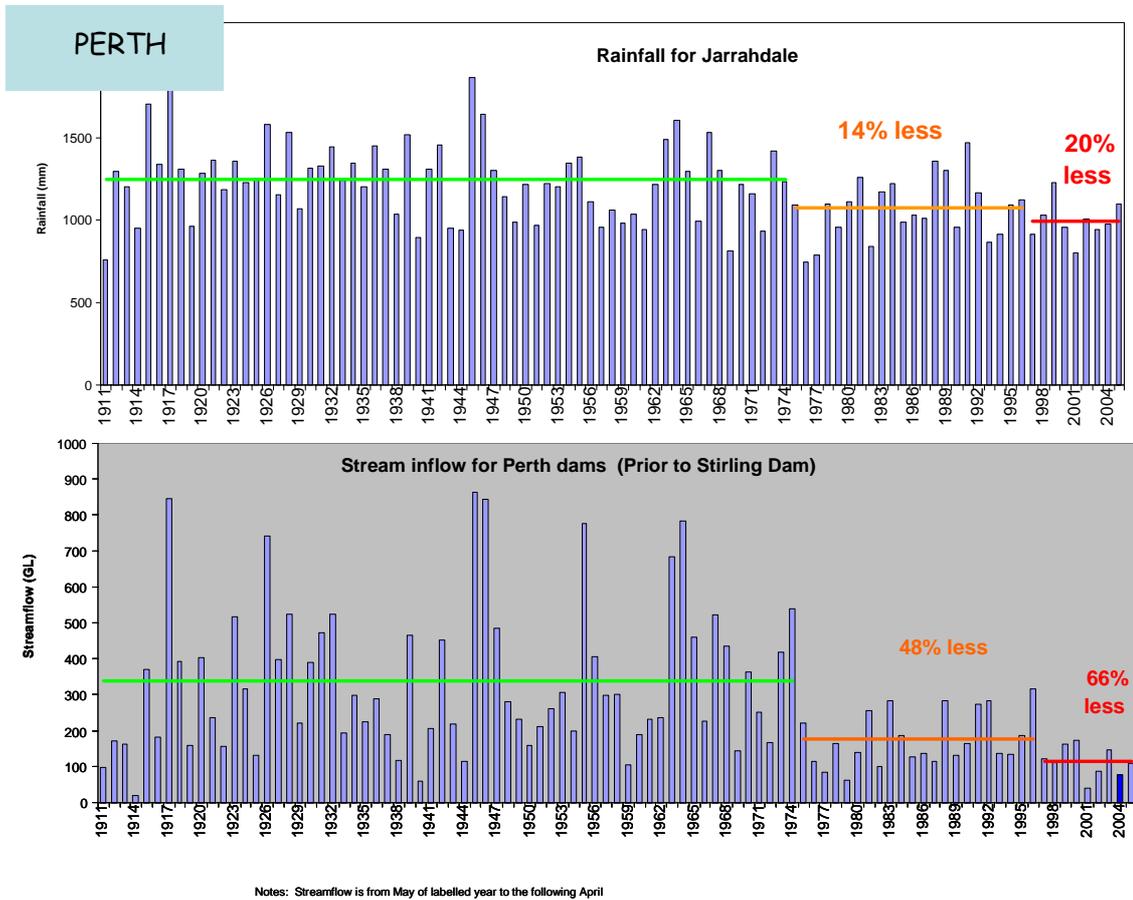
Many of the economic gains from the introduction of allocation trading come from the fact that it enables water use to be optimised. For efficient trading within a season it is first necessary to establish an accounting system that has integrity and, in particular, enables administrators to determine whether or not the person selling a water allocation has actually reduced use by the amount being transferred to another water user. *Metering and conversion to a volumetric allocation system is a necessary precursor to the development of efficient water trading systems.* In order to facilitate the more efficient management of the available resource and trading, Australia has spent many years converting area-based licences to volumetric licences and installing meters. *Typically, conversion involves estimation of the amount of water used by crop type and the development of conversion factors.* In flood irrigation system, especially those on porous soils it may be necessary to define the amount being used as the total amount pumped less the amount deemed to have returned back to an aquifer. Even if there is no intention to trade, the installation of meters opens up the opportunity to reduce allocations per entitlement during droughts and in the event that adverse climate change reduces the amount of water available to irrigators. Once meters are in place, Australian irrigators are generally charged a fixed service fee in proportion to their maximum entitlement and a delivery fee in proportion to the volume used. As indicated above, the sooner volumetric entitlements are converted into shares the easier it is to manage in the face of declining supplies.

Lesson 7: It is difficult for communities to plan for an adverse climate shift and develop water sharing plans that deal adequately with a climatic shift to a drier regime. More robust planning and water entitlement systems are needed.

At massive cost, one of the greatest lessons Australia has learned over the last decade is that dramatic reductions in water supplies should be expected. Figure 6 shows the extent of the reduction in water supplies that have occurred in dam used to supply Perth. Amongst other things, it should be noted that since 1974, mean inflows into Perth's water supply system have never returned to what was thought to be its average supply.

An experience similar to that experienced by Perth now seems to be unfolding in Australia's Southern Connected River Murray system, where there has been drought since 2002. With the benefit of hindsight, it is now clear that allocation policies may need a major rethink. The previous approach was to assume that it was safe to allocate water in the assumption that whilst the minimum inflow record may be broken in one or two months the sum of all minimum inflows would provide a reasonable minimum on which to make allocation decisions. In 2006/07, however, this system broke or equalled its previous minimum monthly inflow record for all but one of 11 months in succession (see Table 1). This apparent shift to a drier regime or a long drought coupled with a recent National Water Commission review of water planning processes has revealed that *community consultation processes find it difficult if not impossible to establish robust water sharing regimes that work during periods of adversity.* As a result, many water sharing plans have had to be suspended and emergency allocation procedures put in place. Australia is now searching for a new way to allocate water that can be expected to cope with whatever climatic regimes emerge.

Figure 6. Declines into Perth's main surface water supply system



Source: Water Corporation, Perth, personal communication.

Lesson 8: The allocation regime for the provision of water necessary to maintain minimum flows, provide for conveyance and cover evaporative losses need to be more secure than that used to allocate water for environmental and other purposes.

Throughout much of Australia, it is common to classify water as either consumptive water or environmental water. In recent times and in the face of adverse shifts in water supplies, however, it is becoming clear that *there is a need to differentiate between the water that is needed to maintain rivers and aquifers at a minimum or basic level, and that needed to service broader environmental needs.* Allocation plans need to begin by setting aside sufficient water to cover evaporative losses, to enable allocations to be conveyed to users and maintain essential functions like flows to the sea. The remaining non-consumptive water can be allocated for environmental users in a manner that enables environmental water use to be varied from year to year in a manner that mimics the normal climatic variation.

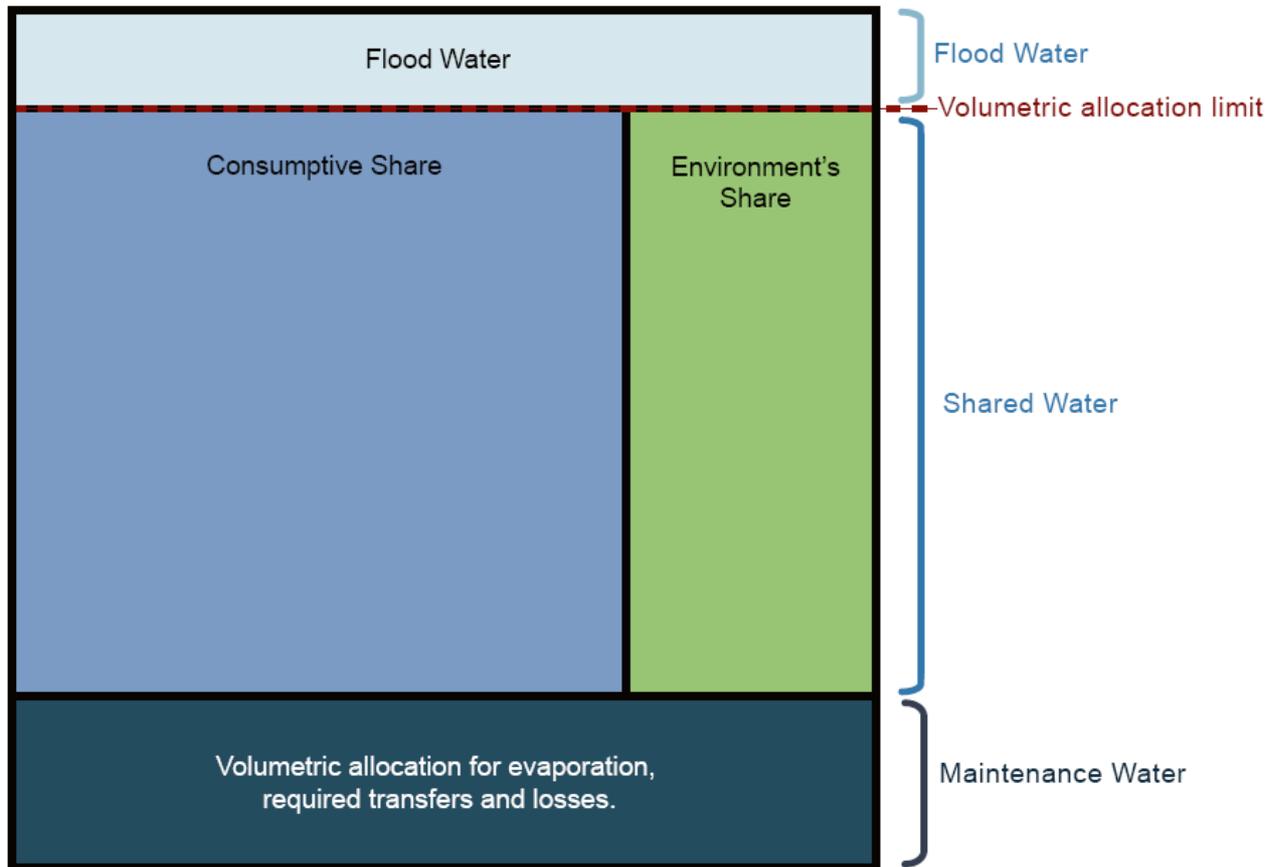
Table 1. Recorded minimum inflows into the River Murray System before 2006/7 and in 2006/7

Month	Previous lowest monthly inflow before 2006		2006 inflow	% of previous minimum inflow
June	110	GL in 1967	110	100%
July	150	GL in 1967	130	87%
August	130	GL in 1902	100	77%
September	180	GL in 1902	120	67%
October	140	GL in 1914	80	57%
November	60	GL in 1914	70	117%
December	60	GL in 1982	60	100%
January	50	GL in 1983	50	100%
February	60	GL in 2003	50	83%
March	50	GL in 1915	50	100%
April	70	GL in 1923	40	57%
May	80	GL in 1902	110	138%
Total	1140		970	

Source: Murray-Darling Basin Commission, pers. com. 2008.

A new Australian development is a decision to begin to define environmental entitlements in the same manner that consumptive use entitlements are defined. In systems, like the southern connected River Murray System, this option has emerged as a consequence of the way water sharing rules were written and the emergence of serious over-allocation problems. In response, it has been decided to restore balance to the system by purchasing entitlements from irrigators and placing these entitlements in the hands of an environmental trustee. *When environmental entitlements are defined in the same manner as the consumptive entitlements issued to irrigators and urban water users, then as the amount of available water is reduced allocations to both sides are made on a pro-rata basis.* The result is an administrative arrangement that ensures that in a dryer regime the environment still receives an allocation.²⁰ Whilst yet to be implemented, the result, when coupled with an arrangement that enables individuals to carry forward unused water, may provide a more robust way to optimise inter-seasonal risk management. Whilst not yet agreed to, the result is an allocation regime that takes the form illustrated in Figure 7.

Figure 7. Indicative structure of water entitlement systems that appear to be emerging in Australia's River Murray System



Source: Young and Mcoll (2008b).

Lesson 9. Unless all forms of water use are accounted for entitlement reliability will be eroded by expansion of un-metered uses like plantation forestry and farm dam development, increases in irrigation efficiency, etc and place the integrity of the allocation system at risk.

In recent times, it has also become apparent that in systems that are allocated to their limit it is critical to put in place a regime that accounts for all significant forms of water use and plan accordingly. Whilst data is still being collected in many areas, it is becoming clear that if the allocation regime does not properly account for processes that either intercept water that previously flowed into the system and for un-metered processes that extract water from the system, these processes will cause fully allocated systems to become over allocated and also, will aggravate existing over-allocating problems.

Interception processes identified in Australia, include increased forestry and the construction of small farm dams and improvements in irrigation efficiency.²¹ Increases in the area under forestry can reduce water availability by intercepting rainfall that otherwise would have run-off into a river system or percolated into an aquifer and, also, by putting roots into shallow aquifers. In order to manage these effects, Australian States are in the process of establishing offset rules that will require those intending to establish a new plantation to first acquire and surrender sufficient water to ensure that the increase in forestry does not erode the reliability of existing entitlements. Similar arrangements are also being put in place to control farm dams. As part of Australia's recent decision to implement a greenhouse gas emissions trading scheme, the design of which is expected to include credit for carbon sequestration, it is expected that resolution of this problem will become more urgent.

Lesson 10. Unless connected ground and surface water systems are managed as a single integrated resource, groundwater development will reduce the amount of water available that can be allocated to surface water users.

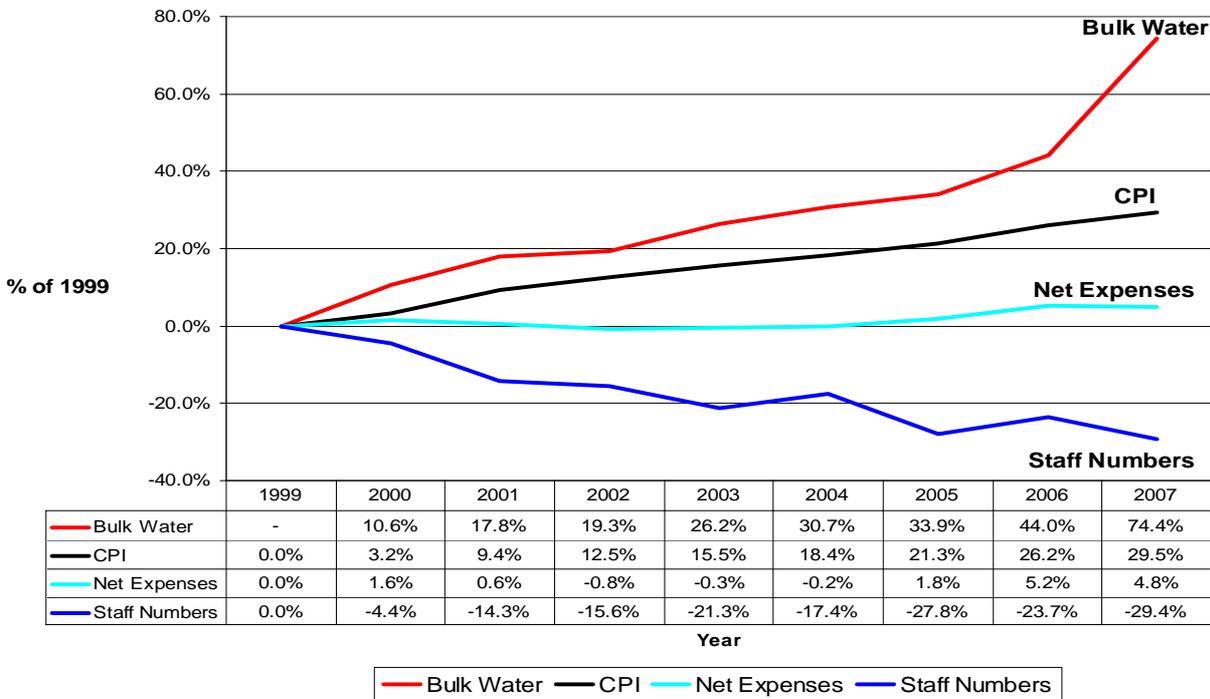
A challenge, yet to be resolved to national satisfaction, is the question of how best to administer and govern connected ground and surface water resources. In the past, ground and surface water resources were managed independently and as if they were not connected to one another. As a result, it was common for separate rather than integrated plans to be prepared for each – even when they were closely connected. Another example of this, which is in the process of being corrected, is the omission of groundwater management considerations from the current Murray-Darling Basin Agreement.²² An issue, yet to be resolved, is the question of how to adjust allocations to connected ground and surface water systems as a system gets drier. As with surface water systems, one option is to set aside enough water to maintain both systems at a minimum level and then use sharing arrangements to determine how much of the remaining water is assigned to the groundwater system shareholders and how much to the surface water system shareholders.

Lessons and challenges associated with the establishment of efficient incentives for the management of water supplies and use

Lesson 11. Water use and investment will be more efficient if all users are exposed to at least the full lower bound cost and preferably the upper bound cost of supplying water to them. One way of achieving this outcome is to transferring ownership of the supply system to these users.

Under the Australia’s National Water Initiative, States agreed to put in place arrangements that would expose all water users to at least the lower bound cost of supplying water to them. Lower bound cost is defined as “... the level at which to be viable, a water business should recover, at least, the operational, maintenance and administrative costs, externalities, taxes or TERS (not including income tax), the interest cost on debt, dividends (if any) and make provision for future asset refurbishment/replacement. Dividends should be set at a level that reflects commercial realities and stimulates a competitive market outcome.”

Figure 8. Index of water supply and delivery costs in real terms since the transfer of ownership and control of water supply assets to Murrumbidgee Irrigation compared with New South Wales government bulk water changes



Source: Murrumbidgee Irrigation, personal communication.

Upper bound cost is defined as “... the level at which, to avoid monopoly rents, a water business should not recover more than the operational, maintenance and administrative costs, externalities, taxes or tax equivalent regimes, provision for the cost of asset consumption and cost of capital, the latter being calculated using a weighted average cost of capital.”

Australian experience has found that one of the easiest ways of achieving such a pricing regime is to transfer ownership of water supply assets to a company owned by all the entitlement holders in an area. As illustrated in Figure 8, the general experience is that the transfer of ownership and independent control to local water users has resulted in considerable savings. In New South Wales’ Murrumbidgee Irrigation System, transfer of responsibility and ownership of the main supply system in that region enabled growers to reduce the costs of supplying water to them.

Lesson 12. Manage environmental externalities using separate instruments so that the costs of avoiding them are reflected in the costs of production and use in a manner that encourages water users to avoid creating them.

In Australia, the National Water Initiative and earlier Council of Australian Government Agreements recommended that the costs of externalities should be included in water charges. In practice, however, there are two ways of doing this. The first way is to add an amount to all water charges. The second way is to put in place a suite of arrangements so that the costs of externalities are reflected in the costs of water use. As a general rule, it is the Australian experience that the cost of many, if not most, externalities are poorly related to the volume of water use. Whenever this is the case, Australian experience suggests that *externalities are more efficiently managed using separate instruments or mechanisms in a manner that provides an incentive for people to avoid creating them.* In the case of salinity management, for example, Australian resource managers are using salinity charges, interstate salinity trading schemes and off-set policies in order to encourage people to invest and manage land in ways that reduce salinity.

Lessons and challenges associated with the establishment of efficient markets

Lesson 13. Removal of administrative impediments to inter-regional trade and inter-state trade is difficult but necessary for the development of efficient water markets.

One of the main reasons for promoting the use of water markets is that they facilitate adjustment with a minimum of political interference and generate significant gains to national and regional economies. As indicated at the start of this report, the gains from trade are substantial and, in Australia, have been repeatedly found to exist. Nevertheless, community and irrigation companies all prefer that water trade into “their” district and out of other districts, and in an effort to ensure that this happens often put in place administrative barriers to trade out of their district. Australian examples of administrative barriers to trade include the development of complex, time-consuming administrative procedures and constraints on how much water can be sold and charges associated with the sale of a water entitlement outside an irrigation district. As management of these issues is sensitive, *Australia has taken the approach of appointing an independent agency to develop rules designed to remove unnecessary barriers to water trade.* Amongst other things, this has required the setting of guidelines that prevent water supply companies from setting charges and adopting practices that discriminate against people who wish to trade water out of a region.

Lesson 14. Markets will be more efficient and the volume of trade greater if entitlements are allocated to individual users rather than to irrigator controlled water supply companies and cooperatives.

Whilst opposed by water supply companies and cooperatives, it is the Australian experience that *willingness to trade and market depth typically is much greater when entitlements are allocated to individuals rather than to water supply companies or associations as they are called in other countries.* The reason for this is that when allocations are issued to individuals they do not have to obtain the permission of the board of a water supply company or association to sell water out of a region. As noted in a recent discussion paper released by the Australian Competition and Consumer Commission, transformation of collectively held water entitlements into set of individual entitlements is complex and requires the development of individual supply contracts that take account of the implications of a person deciding to sell their water and, as a result, stop contributing money towards the costs of maintaining water supply infrastructure. The emerging Australian policy position is that water supply companies should negotiate a supply contract with entitlement holders as soon as it becomes likely that water trading may be introduced to a district.²³

Lesson 15. Equity and fairness principles require careful attention to and discipline in the way that allocation decisions and policy changes are announced.

In regimes where water entitlements and allocations are not tradeable, it is common practice to consult widely before making a policy change or an allocation announcement. In recent times, however, it has become increasingly clear to Australian water administrators that *all policy and allocation announcements must be made in a manner that gives each and every entitlement holder an equal opportunity to profit from a policy change or announcement of an additional allocation.* If this is not done, then accusations of unfairness and even insider trading emerge.

A particular problem has been the need to provide timely access to allocation announcement information across all across jurisdictional boundaries. If irrigators in one state receive information about a policy change before irrigators in another state receive it, then they receive a short-term opportunity to purchase or sell water across the jurisdictional boundary before the other those in the other state become aware of it.

Lesson 16. Water markets are more effective when information about the prices being paid and offered is made available to all participants in a timely manner.

As a general rule, most Australian water markets were developed slowly and grew in size only after information about the nature of prices being offered and paid became available in a timely manner. In this regard, one of the mistakes made by many government departments and the water broking industry has been a failure to collect and share information about prices being paid and the volumes being traded. *When price, market depth and other related information is not readily available it is difficult for people to know how much to pay and, as a result, the extent of trading is less than it otherwise would be.* Whilst leading brokers now regularly publish summary market information, the Australian market still lacks transparency.

When the water market involves many brokers and many different arrangements, the solution to the problem is to require those involved to reveal the price and other related information at the time an application to trade is submitted and for this information to immediately be made available to the public.

Lesson 17. Develop broking industry and avoid government involvement in the provision of water brokering services.

With regard to the role of water brokers and the development of water markets, some Australian governments and some water supply companies have chosen to leave water brokering to third parties whilst others have chosen to establish their own markets and now compete with independent brokers. Recently, Victoria's Competition and Efficiency Commission has drawn attention to the fact that this latter arrangement can result in a conflict of interest.²⁴ The emerging view, not yet supported by all governments, is that the development and management of water markets should be left to third parties so that governments can be not involved in market manipulation.²⁵ Amongst other things, this makes it easier for governments to be involved in buying and selling water entitlements and allocations. The essential rule is that market creators should not be market makers.

Overview – Some design fundamentals

The overall message that this report seeks to convey is that countries should be careful as they contemplate the development of water markets. The potential benefits are significant but only if and only if early attention is given to the sequencing of reforms and the preparation of the allocation and entitlement regime for trading.

Australian experience suggests that investment returns well in excess of 15% per annum are achievable. Unless care is taken, these gains, however, can come at the expense of the environment unless the environment is given an equivalent entitlement.

One of the key observations that emerges from the Australia experience is that water trading is likely to activate water which, before the introduction of trading, was used by the environment and other users. Failure to address this issue and align entitlement systems with hydrological realities in a timely manner can lead to significant over allocation problems.

Another key observation that must be made is that water reform is not an instantaneous process. Water reform is a process that takes time and sequencing is important. Clear policy guidance in the form of documents like Australia's National Competition Policy and its National Water Initiative make it easier to make the transition.

When allocation systems do not align with well known hydrological principles and the emergence of over-allocation is tolerated, the introduction of markets will quickly reveal the extent of the problem and allow entire systems can quickly trade into trouble. The good news is that Australian experience is showing that the solutions to these problems are known and that they can be resolved.

Notes

- 1 www.snowyhydro.com.au.
- 2 Bryan, B. and Marvanek, S. (2004) Quantifying and valuing land use change for Integrated Catchment Management evaluation in the Murray-Darling Basin 1996/97 – 2000/01. Stage 2 Report to the Murray-Darling Basin Commission. Available at www.clw.csiro.au/research/society/peru/publications.html.
- 3 In recognition of this, Governments have committed to a “Living Murray” programme that is seeking *as a first step* to return 500 GL of water to the River Murray system and its environment. 500 GL represents 6% of the existing Cap.
- 4 Young, M.D. and McColl, J.C. (2008a) Double trouble: The importance of accounting for and defining water entitlements consistent with hydrological realities, *Australian Journal of Agricultural and Resource Economics* 53:19-35.
- 5 Section 35, Intergovernmental Agreement on a National Water Initiative between the Commonwealth of Australia and the Governments of New South Wales, Victoria, Queensland, South Australia, the Australian Capital Territory and the Northern Territory, Council of Australian Governments, 25 June 2004. Available at www.nwc.gov.au/www/html/117-national-water-initiative.asp
- 6 Young and McColl (2008b), A future-proofed Basin, University of Adelaide. Available at www.myoung.net.au
- 7 Young, M.D.; Shi, T. and McIntyre, W. (2006) Informing Reform: Scoping the affects, effects and effectiveness of high level water policy reforms on irrigation investment and practice in four irrigation areas. CRC for Irrigation Futures Technical Report No. 02/06.
- 8 The Council of Australian Governments agreed in principle to establish a National Water Initiative on date and approved the final version on 25th June 2004.
- 9 Over-allocation occurs when commitments to supply water are greater than the amount that can be made available. Over-use is said to occur when the balance between the amount of water being taken by consumptive users is greater than that which can be sustained. See the glossary at the end of this paper.
- 10 ACCC, Water infrastructure charge rules Draft advice, April 2009. Available at www.accc.gov.au/content/index.phtml/itemId/867661
- 11 See ACCC Water Charge Rules for Water Planning and Management Charges, Position Paper, January 2009. Available at www.accc.gov.au/content/index.phtml/itemId/857992
- 12 A short summary is available at www.nwc.gov.au/nwi/biennial_assessment/overall_findings.cfm
- 13 Murray-Darling Basin Authority (2009) The Living Murray Environmental Water Recovery Progress Report, February 2009. Available at www.mdba.gov.au/programs/tlm The Living Murray Environmental Water Register data states that it is estimated that by 30 June 2009, a total of 280 GL of water for the environment is expected to have been recovered and that by December 2009 this amount will have risen to 480 GL.
- 14 See Commonwealth environmental water holdings at www.environment.gov.au/water/environmental/cewh/holdings.html
- 15 At the same time and as part of the same A\$303 million purchase, 151.2 GL of general security entitlements and 18.2 Gl of supplementary entitlements were purchased from tributaries to the Darling System in the northern part of the Basin.

- 16 Bjornlund, H. and Rossini, P. (2007) An Analysis of the returns from an investment in water entitlements in Australia. *Pacific Rim Property Research Journal* 13(3):344-360.
- 17 For an excellent summary of the processes put in place to manage the clearance and sale of mortgages see Bjornlund, H. (2008) *Water scarcity and its implications for land management: some lessons from Australia*, Royal Institute of Chartered Surveyors, London. Accessible at www.rics.org/NR/rdonlyres/5F85E6EB-C651-4039-96A0-836261EB2722/0/Waterscarcityandlandmanagement.pdf
- 18 A programme is in place that is seeking to have established connectivity between registers operational in the very near future. The target date is 2009.
- 19 Brennan, Donna (2007a) *Managing Water resource reliability through water storage markets*. Available at www.myyoung.net.au/water/policies/Brennan_Storage_Markets.pdf.
- Brennan, Donna (2007b) *Missing markets for storage and their implications for spatial water markets*. Paper presented to AARES Conference, Queenstown, NZ, 14th February 2007. Available at www.myyoung.net.au/water/policies/Brennan_AARES07_storage_&_trade.pdf.
- Vanderbyl, Tom (2007) *Implementation of continuous sharing in Queensland*. SunWater, Brisbane. Available at http://www.myyoung.net.au/water/policies/SunWater_Continuous_Sharing.pdf.
- Young, M.D and McColl, J.C (2007) *Irrigation water: Use it or lose it because you can't save it*. Droplet 6. Available at www.myyoung.net.au
- 20 Young, M.D and McColl, J.C. (2008) *A future-proofed Basin*, The University of Adelaide.
- 21 For estimates of the extent of this problem see van Dijk, A.; Evans, R.; Hairsine, P.; Khan, S.; Nathan, R; Paydar, Z.; Viney, N.; and Zhang, L. (2006) *Risks to the shared water resources of the Murray-Darling Basin*. Part II in a two part series on the shared water resources of the Murray-Darling Basin prepared for the Murray-Darling Basin Commission. CSIRO Water for a Healthy Country, Canberra. Available at www.mdbc.gov.au/nrm/risks_to_shared_water_resources.
- Vertessy, R., Rahman, J., Bessard, Y. and Zhang, L. (2000) *Predicting the impacts of afforestation on water yield*. *Water* 27(6):16-19.
- Vertessy, R.A., Zhang, L. and Dawes, W.R. (2003) *Plantations, river flows and river salinity*. *Australian Forestry*, 66(1): 55-61.
- Young, M.D. and McColl, J.C. (2003) *Robust reform: The case for a new water entitlement system for Australia*. *Australian Economic Review* 36(2):225-34.
- 22 Under the proposed new Basin Plan to be prepared by a new independent Murray-Darling Basin Authority, it is proposed that sharing rules for these two closely connected bodies will be integrated.
- 23 Australian Competition and Consumer Commission (2008) *Water market rules issues paper*, Commonwealth of Australia, April 2008. See also Australian Competition and Consumer Commission (2006) *A regime for the calculation and implementation of exit, access and termination fees charged by irrigation water delivery businesses in the southern Murray-Darling Basin*. Commonwealth of Australia.
- 24 Competition and Efficiency Commission (2007) *Competitive Neutrality Complaint Investigation: Final report on "Water trading services provided by Watermove,"* Government of Victoria, 1 June 2007. Available at [www.vcec.vic.gov.au/CA256EAF001C7B21/WebObj/FINALREPORTonVCECwebsite2July07/\\$File/FINAL%20REPORT%20on%20VCEC%20website%20%20July%2007.pdf](http://www.vcec.vic.gov.au/CA256EAF001C7B21/WebObj/FINALREPORTonVCECwebsite2July07/$File/FINAL%20REPORT%20on%20VCEC%20website%20%20July%2007.pdf)
- 25 Bjornlund (2008) reports that "The National Water Commission seems to conclude that it would be too costly an option to introduce mandatory licensing of intermediaries and has instead suggested relying on existing consumer protection and has appealed to the industry for self-regulation. In that context it has suggested that it would be useful:
- i) for brokers to form an Australian Water Agents Association with a code of practice and a voluntary accreditation scheme;
 - ii) to develop consistent protocols to handle complaints about the conduct of intermediaries;
 - iii) to improve market design to streamline trade approval, clarify intermediary obligations to both authorities and their clients and develop contract templates; and

iv) improve lines of communications between intermediaries about trading rules and protocols. (Matthews, 2007).” These views are similar to those recommended in a report to the National Water Commission by prepared the Allen Consulting Group (2007).

One of Australia’s leading water brokers, Waterfind (2007) takes the opposite view and is calling for the regulation of water brokers. As a bare minimum, brokers should be required to

- Process all transactions through audited trust accounts;
- Hold professional indemnity insurance;
- Be separated from any regulatory and not hold transfer approval powers; and
- Be liable to a fine or licence suspension for non adherence to the code of practice

Annex 1.

GLOSSARY OF TERMS (Extracted from Australia's national water initiative)

Consumptive pool – the amount of water resource that can be made available for *consumptive use* in a given water system under the rules of the relevant water plan.

Consumptive use – use of water for private benefit consumptive purposes including irrigation, industry, urban and stock and domestic use.

Environmentally sustainable level of extraction – the level of water extraction from a particular system which, if exceeded would compromise key environmental assets, or ecosystem functions and the productive base of the resource.

Lower bound pricing – the level at which to be viable, a water business should recover, at least, the operational, maintenance and administrative costs, externalities, taxes or TERs (not including income tax), the interest cost on debt, dividends (if any) and make provision for future asset refurbishment/replacement. Dividends should be set at a level that reflects commercial realities and stimulates a competitive market outcome.

Over-allocation – refers to situations where with full development of water access entitlements in a particular system, the total volume of water able to be extracted by *entitlement holders* at a given time exceeds the *environmentally sustainable level of extraction* for that system.

Over-used – refers to situations where the total volume of water actually extracted for consumptive use in a particular system at a given time exceeds the *environmentally sustainable level of extraction* for that system. Overuse may arise in systems that are over-allocated, or it may arise in systems where the planned allocation is exceeded due to inadequate monitoring and accounting.

Reliability – the frequency with which water allocated under a *water access entitlement* is able to be supplied in full. Referred to in some jurisdictions as “high security” and “general security”.

Upper bound pricing – the level at which, to avoid monopoly rents, a water business should not recover more than the operational, maintenance and administrative costs, externalities, taxes or tax equivalent regimes, provision for the cost of asset consumption and cost of capital, the latter being calculated using a weighted average cost of capital.

Water access entitlement – a perpetual or ongoing entitlement to exclusive access to a share of water from a specified *consumptive pool* as defined in the relevant *water plan*.

Water allocation – the specific volume of water allocated to water access entitlements in a given season, defined according to rules established in the relevant water plan.

Water tagging – an accounting approach that allows a traded water access entitlement to retain its original characteristics when traded to a new jurisdiction and/or trading zone, rather than being converted into a form issued in the new jurisdiction and/or trading zone.

Bibliography

- Allen Consulting Group (2007) *Improving market confidence in water intermediaries*. National Water Commission, Canberra. Waterlines Occasional Paper No. 3, July 2007. Accessible at www.nwc.gov.au/publications/docs/Improving_market_confidence_in_water_intermediaries.pdf.
- Competition and Efficiency Commission (2007) *Competitive Neutrality Complaint Investigation: Final report on "Water trading services provided by Watermove,"* Government of Victoria, 1 June 2007. Available at [www.vcec.vic.gov.au/CA256EAF001C7B21/WebObj/FINALREPORTonVCECwebsite2July07/\\$File/FINAL%20REPORT%20on%20VCEC%20website%202%20July%2007.pdf](http://www.vcec.vic.gov.au/CA256EAF001C7B21/WebObj/FINALREPORTonVCECwebsite2July07/$File/FINAL%20REPORT%20on%20VCEC%20website%202%20July%2007.pdf).
- Australian Competition and Consumer Commission (2008) *Water market rules issues paper*, Commonwealth of Australia, April 2008. {See also Australian Competition and Consumer Commission (2006) *A regime for the calculation and implementation of exit, access and termination fees charged by irrigation water delivery businesses in the southern Murray–Darling Basin*. Commonwealth of Australia. }
- Bjornlund, H. and Rossini, P. (2007) "An Analysis of the returns from an investment in water entitlements in Australia", *Pacific Rim Property Research Journal* 13(3):344-360
- Bjornlund, H. (2008) *Water scarcity and its implications for land management: some lessons from Australia*. Royal Institute of Chartered Surveyors, London. Available at www.rics.org/NR/rdonlyres/5F85E6EB-C651-4039-96A0-836261EB2722/0/Waterscarcityandlandmanagement.pdf
- Brennan, D. (2007a) *Managing Water resource reliability through water storage markets*. Available at www.myyoung.net.au/water/policies/Brennan_Storage_Markets.pdf
- Brennan, D. (2007b) *Missing markets for storage and their implications for spatial water markets*. Paper presented to AARES Conference, Queenstown, NZ, 14th February 2007. Available at www.myyoung.net.au/water/policies/Brennan_AARES07_storage_&_trade.pdf
- Bryan, B. and Marvanek, S. (2004) "Quantifying and valuing land use change for Integrated Catchment Management evaluation in the Murray-Darling Basin 1996/97 – 2000/01". Stage 2 Report to the Murray-Darling Basin Commission.
- CoAG (2008a) Communiqué. Council of Australian Governments' Meeting, Adelaide, 26 March 2008.
- CoAG (2008b) Council of Australian Governments. Report to Council of Australian Governments, 26 March 2008. Available at www.coag.gov.au/coag_meeting_outcomes/2008-03-26/docs/CCWWG_water_report.doc
- Frontier Economics (2007) *The Economic and Social Impacts of Water Trading*. Report prepared in association with Tim Cummins and Associates, Dr Alistair Watson, and Dr Elaine Barclay and Dr Ian Reeve of the Institute for Rural Futures, University of New England for the National Water Commission, Canberra. Available at www.nwc.gov.au/publications/docs/EconomicSocialWaterTrade.pdf
- Matthews, K. (2007) *Building our water markets*. Distilled 23, October. "The Monthly Newsletter of from the national Water Commission". National Water Commission, Canberra.
- National Water Commission (2007) *First biennial assessment of National Water Commission*, Canberra.

- van Dijk, A.; Evans, R.; Hairsine, P.; Khan, S.; Nathan, R; Paydar, Z.; Viney, N.; and Zhang, L. (2006) "Risks to the shared water resources of the Murray-Darling Basin". Part II in a two part series on the shared water resources of the Murray-Darling Basin prepared for the Murray-Darling Basin Commission. CSIRO Water for a Healthy Country, Canberra. Available at www.mdbc.gov.au/nrm/risks_to_shared_water_resources.
- Vanderbyl, T. (2007) *Implementation of continuous sharing in Queensland*. SunWater, Brisbane. Available at www.myong.net.au/water/policies/SunWater_Continuous_Sharing.pdf.
- Vertessy, R.; Rahman, J.; Bessard, Y. and Zhang, L. (2000) "Predicting the impacts of afforestation on water yield". *Water*, 27(6):16-19.
- Vertessy, R.A., Zhang, L. and Dawes, W.R. (2003) "Plantations, river flows and river salinity". *Australian Forestry*, 66(1):55-61.
- Waterfind (2007) *Waterfind Supports National Regulation*. Press release dated 11 December 2007. See www.waterfind.com.au.
- Young, M.D and McColl, J.C. (2007) *Irrigation water: Use it or lose it because you can't save it*. Droplet 6. Available at www.myong.net.au
- Young, M.D. and McColl, J.C. (2003) "Robust reform: The case for a new water entitlement system for Australia". *Australian Economic Review* 36(2):225-34.
- Young, M.D. and McColl, J.C. (2005) "Defining tradable water entitlements and allocations: A robust system". *Canadian Water Resources Journal* 30(1):65-72.
- Young, M.D. and McColl, J.C. (2008a) "Double trouble: The importance of accounting for and defining water entitlements consistent with hydrological realities". *Australian Journal of Agricultural and Resource Economics* 53:19–35.
- Young, M.D. and McColl, J.C. (2008b), *A Future-proofed Basin: A New Water Management Regime for the Murray-Darling Basin*, The University of Adelaide, Adelaide, Australia.
- Young, M.D.; Shi, T. and McIntyre, W. (2006) *Informing Reform: Scoping the affects, effects and effectiveness of high level water policy reforms on irrigation investment and practice in four irrigation areas*. CRC for Irrigation Futures Technical Report No. 02/06.