PUBLIC POLICY VOLUME 3 NUMBER 1 2008 67 – 86

Planning for Water Security in the Murray-Darling Basin

Daniel Connell*
The Australian National University

R Quentin Grafton
The Australian National University

The 'Big Dry' that has afflicted large parts of the Murray–Darling Basin for at least the past five years has generated major changes in water policy and government funding. Using a 'bottom-up' approach six governance criteria are used to evaluate how key policy developments (the 2004 *National Water Initiative*, the 2007 *National Plan for Water Security* and its reformulation in 2008 as the *Water for the Future Package*, the Water Act 2007, and the Council of Australian Governments (COAG)' March 2008 *Memorandum of Understanding on Murray–Darling Basin Reform* and July 2008 *Intergovernmental Agreement on Murray-Darling Basin Reform*) could be modified to promote water security.

The 'Big Dry' in South-east Australia has focussed policy makers on what is wrong with water policies in Australia in both urban (Quiggin 2006) and rural environments. In this paper we develop a set of governance criteria to guide decision makers to improve water management outcomes in the Murray–Darling Basin. Using these criteria, we provide a 'bottom-up' approach to evaluate the key policy developments in rural water of the past five years that include: the 2004 *National Water Initiative* (NWI) (COAG 2004); the 2007 *National Plan for Water Security* (Department of the Prime Minister and Cabinet 2007) and its reformulation as the *Water for the Future Package* (Wong 2008a); the Commonwealth *Water Act 2007* (Commonwealth of Australia 2007); and the Council of Australian Governments (COAG) March 2008 *Memorandum of Understanding on Murray–Darling Basin Reform* (COAG 2008b) and the July 2008 *Intergovernmental Agreement on Murray-Darling Basin Reform* (COAG 2008a).

First, we review the key characteristics of the Murray–Darling Basin and the history of its management. Second, we define water security and propose six governance criteria to promote it. Third, we address some of the pitfalls and opportunities to achieve national water security by evaluating key features of the recent policy developments in water. In the final section, we provide concluding remarks.

* This paper is dedicated to Dr Peter Cullen AO FTSE whose voice of reason and integrity on Australian water policy is sadly missed.

Daniel Connell is a research fellow with the Australian National University Water Initiative and the Crawford School of Economics and Government and the author of Water Politics in the Murray–Darling Basin (Federation Press 2007).

R Quentin Grafton is Professor of Economics and at the Crawford School and Co-Chair of the ANU Water Initiative. Contact Details: R. Quentin Grafton, Crawford School of Economics and Government, Australian National University, J.G Crawford Building (13), Ellery Crescent, Canberra ACT 0200. Email: quentin.grafton@anu.edu.au Tel: +61 2 6125 6558.

Authorship is alphabetical.

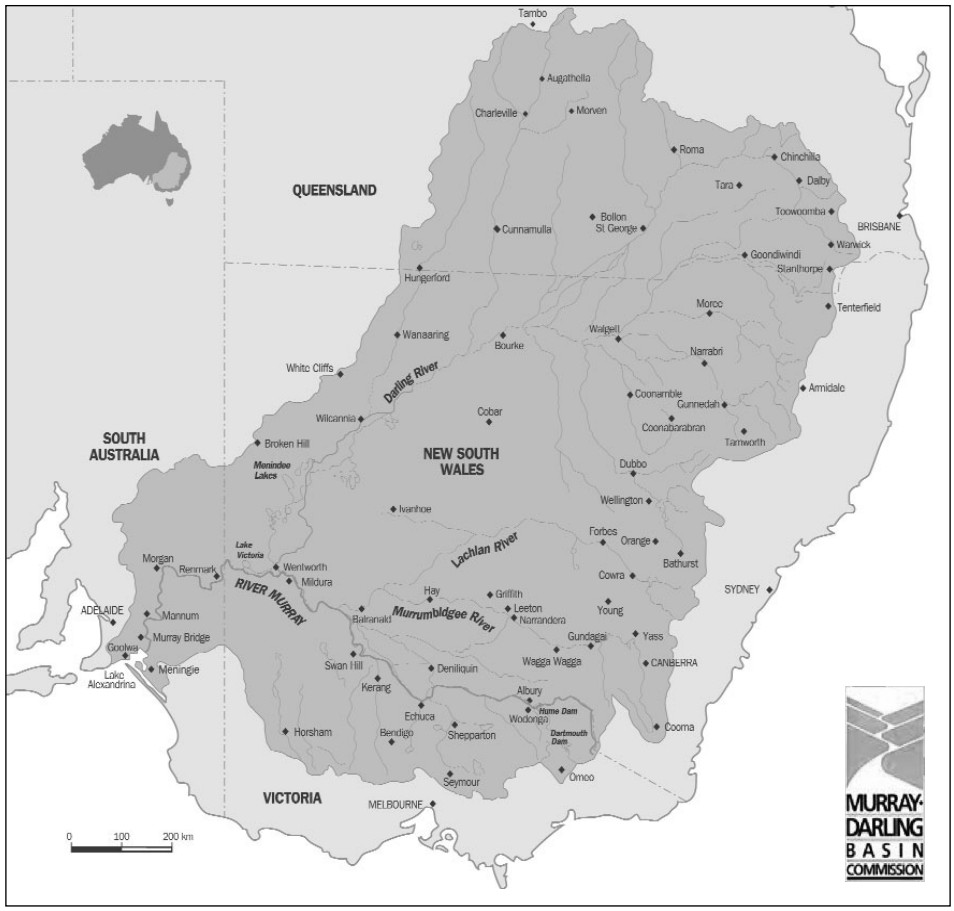
 ISSN 1833-2110

The Murray-Darling Basin: an overview

The Murray–Darling Basin is just over a million square kilometres in size and has a diverse range of landscapes, ecosystems, land uses and climates. It includes the sub-tropical north with its wet summers and dry winters and the temperate south characterised by long and dry summers, wet winters, and snowfields (see Figure 1). Much of the water supplied to the Basin in the south is sourced from the temperate region primarily from the Australian Alps and the rivers of northern Victoria.

The Basin generates approximately 40 percent of Australia's agriculture and pastoral production by value (Blackmore 2002:7). It also includes over 30,000 wetlands, eleven of which are listed under the Ramsar Convention of Wetlands of International Importance. Divided between the southern and eastern Australian states of New South Wales, Victoria, South Australia and Queensland and the Australian Capital Territory (ACT), the region is home to just under two million people and supplies much of the water used by another million in South Australia. Those three million people and various industrial activities use about 4 percent of the water diverted from the region's rivers. The other 96 percent is used by irrigated agriculture and constitutes about two thirds of the national rural and urban usage.

Figure 1: Map of the Murray–Darling Basin



Source: Murray–Darling Basin Commission (2007).

A federal overlay on top of the four states and one territory jurisdiction, each with numerous local government and catchment authorities, provide an extra political dimension that is not found in any other major Australian river system. The main threat to the system is overuse from irrigation diversion. Other anthropogenic risks to the environment include salinity and nutrient pollution caused by changing land management practices in the catchments. These factors are exacerbated by the fact that the Murray–Darling Basin is a low energy system with little capacity to purge itself of salts and sediments. For instance, even when there is natural flow out of the Murray Mouth, which has not occurred for a number of years as dredging is required to keep the Mouth open, salts are redistributed to what were previously fertile low lying areas, or onto floodplains of high environmental value.

Water Management in the Murray-Darling Basin

Before the current push for water reform there were two previous major attempts by governments to assess what is required to manage the Murray–Darling Basin — the first in the early decades of the twentieth century and the second in 1980s. The early royal commissions that led to the *River Murray Waters Agreement* (RMWA) in 1914/15 stressed the need for a catchment-wide approach to policy and management. After years of difficult negotiation the RMWA put in place a tightly conscribed water sharing agreement. This agreement eventually broke down in the 1970s and 80s due to growing development pressures and increasing salinity problems.

In the mid-1980s the Murray–Darling Basin Ministerial Council (Ministerial Council), the Community Advisory Committee and also the Murray–Darling Basin Commission (MDBC) replaced the River Murray Commission. These new bodies were designed to take account of a broader range of political, community, productivity and environmental interests under the Murray–Darling Basin Agreement (Kellow 1995:220-238). Unfortunately, they proved incapable of resolving many of the major challenges that threaten environmental sustainability and resource security in the Basin, in part, because of the requirement that all decisions by the Ministerial Council required the unanimous approval of all governments.

The Cap

In response to concerns about overuse of water the Murray-Darling Basin Ministerial Council agreed in 1995 to limit overall diversions through a process generally known as “the Cap”. The Cap is currently limited to surface water and is not a fixed quantity of water. It varies according to seasonal conditions and is the volume of water that would have been used if the rainfall of the year in question coincided with the infrastructure, type and distribution of crops and the management rules in place in 1993-94 (MDBC 2002, p 66).

When first introduced, the Cap was seen as an initial step towards achieving acceptable levels of environmental sustainability. In other words, the Cap was a determined attempt to call a halt to further water use prior to ‘winding back’ development pressures. Despite many official statements of intent, however, the Cap was never extended to include groundwater or encompass much of the northern section of the Basin (Murray–Darling Basin Ministerial Council 2001). The failure to follow through on full implementation of the Cap in the late 1990s and early 2000s is symptomatic of the more general failure of the Ministerial Council able to build on its earlier achievements and put in place a system of water management to prevent long-term decline in environmental conditions (Connell 2007). Recognition of these deficiencies was one of the main factors behind the push for major institutional change over the past five years.

Recent Institutional Change

Efforts to understand the on-going process of water reform should start with an analysis of what went wrong with the Murray–Darling Basin Agreement and the arrangements put in place in the mid-1980s. In 2001, Don Blackmore — the then Chief Executive of the MDBC — stated that growth in water extractions had been halted but there was no agreement about what was meant by the term 'sustainable river' or how to achieve that condition. He also reflected that the Ministerial Council was a highly politicised forum where it was difficult to use benefits to the Basin as a whole as a significant criteria for decision-making (Blackmore 2002:6-7).

In the past decade or so Australian governments have chosen to negotiate water reform primarily through the COAG. This forum produced a broad agreement on water reform in 1994, the *National Water Initiative* (NWI) in 2004, and most recently the *Memorandum of Understanding on Murray–Darling Basin Reform* (MOU) in March 2008 and the *Intergovernmental Agreement on Murray–Darling Basin Reform* (IGA) in July 08. The 1994 COAG reforms were noteworthy for the promotion of market-based approaches to address water scarcity and, in particular, agreement in principle to remove unnecessary restrictions on water trading. The NWI extended the COAG reform agenda and provided a policy framework designed to increase water security through more robust water entitlements, removal of unnecessary barriers to water trading, and comprehensive water plans to protect irrigation and other interests such as supply to urban centres and ensure sustainable diversions to conserve the environmental conditions of both surface and sub-surface hydrological systems. The March 2008 MOU and July 2008 Intergovernmental Agreement was an agreement by all states, the ACT and the Commonwealth Government about how to implement the changes outlined in the *Water Act 2007*.

The stated aim of the NWI is to force water managers to negotiate a balance between irrigation and other interests and establish clear pathways to return all surface and groundwater systems to environmentally sustainable levels of extraction (paragraph five). Central to the NWI is the commitment by its signatory governments to take a whole-of-system approach, and after agreement has been reached on the level of modification appropriate for a given hydrological system, to give priority to the provision of the water necessary to stabilise environmental conditions and resource security at that point (Stoeckel and Adams 2007). As such, it represents a conceptual shift from the approach taken for over a century which viewed water management as a process designed to promote and coordinate increased water use.

The *Water Act 2007* established the Murray–Darling Basin Authority (MDBA) that will oversee a Basin Plan for the integrated and sustainable management of water resources in the MDB. This Basin Plan will set limits for both groundwater and surface water consumption based on yet to be determined long-term average sustainable diversion limits that will be progressively adjusted in response to information from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Bureau of Meteorology. The latter organisation also now has an important monitoring role under the Act. The Basin Plan will provide the parameters for the water resource plans that will be prepared at the state level and will also identify and develop strategies to manage risks to water resources (such as climate change and the growth in farm dams and plantation forestry). A key provision of the Act is the creation of a Commonwealth Environmental Water Holder (CEWH). It will manage the Commonwealth's holdings of environmental water according to principles meant to ensure consistency with the Environmental Watering Plan to be developed by the MDBA as

part of the Basin Plan. The CEWH will also consult with state governments on the use of their own environmental water.

The March 2008 MOU and the July 2008 IGA supplement the *Water Act 2007*. Under the new arrangements the MDBA will incorporate the Murray–Darling Basin Commission and prepare the new Basin Plan which will be available in early 2011. It also creates a Ministerial Council to advise the MDBA on the Basin Plan. The MOU is noteworthy in that it represents agreement by all six governments with responsibilities in the MDB that the appropriate Commonwealth Minister is the final decision maker for the Basin Plan. The new Ministerial Council or individual governments will be able to request that the contents of the Basin Plan be reconsidered but the final decision about an objection will be taken by the relevant Commonwealth minister. The Commonwealth Minister does not have to accept the Basin plan as proposed by the MDBA but requests for changes must be tabled in the Commonwealth Parliament. However, if a State Minister disagrees with parts of the Basin Plan it will be referred back to the MDBA for reappraisal. Significantly, the MOU preserves the existing state water shares as defined in the Murray–Darling Basin Agreement and subsequent Ministerial Council decisions.

The March 2008 MOU endorses the overall $10 billion budget made under the *National Plan for Water Security* announced in January 2007 by Prime Minister John Howard. Part of the price of Victoria's agreement to this new arrangement is a guarantee of $1 billion of Australian government funding to promote water efficiency in Victorian agriculture. This will be invested in irrigation infrastructure within Victoria to increase water-use efficiency and is expected to deliver additional environmental flows into the Murray River equal to 100 gigalitres (GL).[1] The other states also have similar 'priority projects' that have been approved under the IGA with funding linked to progress with the water reform goals. As a condition insisted upon by the states before they agreed to the March 2008 MOU, existing water-sharing plans will continue until their expiry dates (Victoria's water plan expires in 2019) even if they may not be compliant with the sustainability principles of the NWI.

Water and the Environment

A recent comprehensive review of the Murray-Darling's ecological condition concluded it was 'significantly impaired' and no longer 'healthy' (Cooperative Research Centre for Freshwater Ecology 2003). This 'report card' vindicated Stuart Blanch, then working for the Australian Conservation Foundation, and Tim Holden of the New South Wales Environmental Defenders Office, who argued in 2001 that the Murray–Darling Basin Agreement should be rewritten to reflect the much stronger concern for the environment contained in *Agenda 21* and other international and national agreements that were approved since the Murray–Darling Basin Agreement was negotiated in the late 1980s and 1990s (Blanch and Holden 2001). They were particularly critical of the lack of requirement that policies should be designed to achieve environmental sustainability using the best available science. They also argued that the Murray–Darling Basin Agreement is primarily a treaty between parochial states focused on the sharing of water for irrigation and the management of salinity impacts on the lower reaches in South Australia. Their conclusions are similar to those of the 2001 South Australian Parliament's Select Committee on the River Murray.

---

1 1 gigalitre (GL) = 1 billion litres and 1 megalitre (ML) = 1 million litres.

For a new water management paradigm to be implemented, a way has to be found to bridge the difference between the reduced volume of water that is expected to result from the exercise of setting a sustainable Cap under the 2011 Basin Plan and the existing commitments to entitlement holders contained in the water sharing plans. Under the risk–sharing provisions outlined in paragraphs 45 to 49 of the NWI, the costs that would come from bringing entitlements into line with sustainable levels of extractions were to be borne by the entitlement holders until 2014. If this approach had been taken, however, it would have caused financial hardship to many irrigators and resulted in political opposition that would have seriously delayed reform.

The $10 billion *National Plan for Water Security* — revamped and renamed the *Water for the Future* package — was meant to resolve this dilemma. At present, the most comprehensive and implemented intergovernmental response to the overuse of water is the 2004 *Intergovernmental Agreement on Addressing Water Overallocation and Achieving Environmental Objectives in the Murray–Darling Basin* (IGMDB), commonly called *The Living Murray* (TLM). The TLM does not change the Cap directly but establishes arrangements for investing $500 million to return up to 500 GL of water to the Murray by 30 June 2009. The success of these initiatives are to be judged from environmental improvements at six 'icon sites' along the Murray River (including the Murray River Channel) chosen for their conservation, recreational, cultural and economic value (MDBC 2008a). The 500 GL target is to be achieved by infrastructure investments to improve water efficiency that are expected to deliver between 300-350 GL of water and the purchase of water entitlements that could contribute around 200 GL of water.

Promoting Water Security

A key aim of water policy over the past decade in the Murray–Darling Basin has been to promote water security. As with many worthy goals that are almost universally accepted but rarely achieved, water security has different meanings depending on the context within which it is used and who is using the term.

In the context of the Murray-Darling Basin, we define water security as an outcome of the processes and actions of water managers to 'secure' an agreed flow of sustainable public and private benefits that explicitly account for climate variability and encompasses all uses and non-uses (including the environment). Water security is, thus, not about ensuring a fixed quantity of water to irrigators, or even for the environment, regardless of climatic conditions, but is the achievement of the most desirable spatial mix of use and non-uses of water given the actual inflows, evaporation and the quality of existing environmental assets (such as biodiversity). It follows that the 'goalposts' to measure water security will change as we know more about the interaction between water flows and land use and become more aware about how to improve environmental outcomes. Given that water and land-use management is subject to the irreducible uncertainties of nature, water security is also about ensuring that bio-physical as well as socio-economic systems are resilient or robust to shocks under a wide range of conditions (droughts, floods and everything in between).

The 'levers' to achieve water security are the institutional or governance structures established to manage land and water resources in the Murray-Darling Basin. We present below what we consider to be six key governance conditions that, at a minimum, we believe need to be satisfied to achieve water security in the Murray-Darling Basin. Collectively, we give these conditions the acronym "TACTIC", standing for: Transparency in governance;

Active-adaptive management; Co-operation and effective co-ordination across jurisdictions; evaluation of Trade-offs; full consideration of Interdependencies; and adequate financial and human Capacity to manage water.

Outlining each condition in detail:

1. Transparency in governance: Governance arrangements need to promote transparency at the macro-level, such as the setting of overall limits on water use, and also the micro-level in the form of reliable price and quantity data on trades and also proper monitoring. For instance, a report prepared for the Ministerial Council by the consultants Marsden Jacob released in 2005 identified poor quality data and monitoring as a major factor undermining effective water management in the Basin (Marsden Jacob Associate 2005). Good governance also requires clear lines of authority so that those responsible for decisions are held accountable for their actions;

2. Active-adaptive management: Active adaptive management recognises there are inherent uncertainties in the Murray–Darling Basin system and managers need to plan for alternative scenarios. It demands experimentation, especially of different management approaches and flow regimes to achieve measurable environmental goals, and to learn from past successes and failures so as to improve decision-making. It also requires timely and flexible management response to both changes in the Basin and important updates in information;

3. Co-operation and effective co-ordination across jurisdictions: Given past deficiencies to achieve Basin-wide outcomes, effective co-operation and co-ordination across local, state, territory and federal jurisdictions of both water and land-use management is fundamental to achieving effective governance;

4. Evaluation of Trade-offs: Until, and unless, there is an understanding of the net benefits and trade-offs associated with directing water to different uses (to irrigation from the environment or vice versa spatially and intertemporally) decision making will be at the whim of the political interests and influences of the moment that may not be in the long-term interest of water security. Important trade-offs also exist in terms of government spending to ensure public funds are used in a cost-effective manner so as to maximise public benefits;

5. Full consideration of Interdependencies: The Murray-Darling Basin has many important interdependencies whether they are between ground and surface water, upstream and downstream use, recreational and irrigation uses, land use and water quality and all other important feedbacks within the system. Effective governance, thus, requires good bio-physical understanding and also institutional structures that allow consideration of the impacts of actions on others, spatially and temporally; and

6. Adequate financial and human Capacity to manage water: A critical issue is the shortage of skilled people able to do the range of tasks required for contemporary water management as required by the NWI. It demands that water management encompass the critical problems of acid-sulphate soils, nutrient pollution, carbon depletion, changing patterns of rainfall, run-off and recharge, loss of native vegetation, threatened biodiversity, declining connectivity between floodplains and streams channels, changes to the seasonal pattern of flows, thermal pollution

> downstream of dams, Indigenous issues, degraded amenity, the social impacts of economic and environmental change, climate change and more. Without the necessary human and financial capacity, managing water and land resources in the Murray-Darling Basin will not be able to achieve water security;[2]

TACTIC provides a 'bottom up' approach to evaluating what might be missing in terms of recent institutional changes (NWI; *Water Act 2007; National Plan for Water Security*; and the MOU), and what might need to be modified if water security is to be realised in the MDB. We focus our assessment on existing state water plans that form a cornerstone of the NWI; the Commonwealth Environmental Water Holder created by the *Water ACT 2007*; the 2008 *Water for the Future Plan*; and the governance arrangements for the Basin Plan endorsed by all governments under the 2008 MOU and the July 2008 IGA.

Water Plans

According to the NWI, the tensions between the many different demands that are placed on hydrological systems are to be managed through the development of comprehensive water plans. The water plans are to include: secure water access entitlements; statutory based planning; statutory provision for environmental and public benefit outcomes; plans for the restoration of over-allocated and stressed systems to 'environmentally sustainable levels of extraction'; the removal of barriers to trade; clear assignment of risk for future changes in available water; comprehensive and public water accounting; policies focused on achieving water efficiency and innovation; and capacity to address emerging issues and many more elements (paragraphs 23 and 25, schedule E). They are also to provide for 'adaptive management of surface and groundwater systems' (paragraph 25) with their connectivity recognised where it is significant (paragraph 23).

The water plans are supposed to either arrest the long-term decline in water security that led to the NWI, or if further decline is unavoidable, to ensure that the cost is shared according to a set of agreed principles. The NWI requires that hydrological systems be managed so that environmental conditions and resource security be stable at the level of modification agreed to through the political process. Many sections of the NWI make it clear that once the level of river or surface water modification has been determined then the volume of environmental flows needed to maintain stability of environmental condition and resource security at that level should be a priority and not an 'optional extra'. For instance, paragraph 23 of the NWI lists as the aim of state water plans to 'complete the return of all currently over-allocated or overused systems to environmentally sustainable levels of extraction'.

The process of large scale water reform unavoidably involves compromises but to meet the criteria put forward by our TACTIC framework, water plans will need to be responsive to emerging threats. Preserving existing water shares between the states and maintaining existing infrastructure will make that much more difficult. The cost of compromises that erode the effectiveness of reforms needed to manage climate change and other potential impacts on the environment and water resource security will be very high.

---

2 Several initiatives are under way to address the capacity problem including a proposal for a national audit of skills needs and gaps in the water sector Working Group on Climate Change and Water (2008, p. 12).

Commonwealth Environmental Water Holder

A key feature of the *Water Act 2007* is the creation of a Commonwealth Environmental Water Holder that will manage the national government's holdings of water entitlements acquired through direct purchase of water entitlements or via investments in water efficiency improvements. Provided the CEWH manages its holdings in a way consistent with the Basin Plan it will be allowed to trade in both water entitlements and seasonal allocations of water. The operating rules for the CEWH, including in terms of water trading, will be set by the appropriate Commonwealth Minister (Clause 109 of the *Water Act 2007*).

The Act's stated intention is to ensure the independence of the CEWH to achieve desired, but as yet unspecified environmental goals. The operating rules of the CEWH for regulating environmental flows are to be set by the Commonwealth Minister but must be consistent with the Basin Plan. This discretion does allow, however, for the possibility of political interference into the operations of the CEWH. The incentive for irrigators to direct political pressure to the Commonwealth Minister will be greatest when inflows and water storage levels are low relative to the long-term average — when irrigators will have the greatest need for their seasonal allocations. Indeed, influential figures in Australian agriculture, such as Mike Keogh, the Executive Director of the Australian Farm Institute, doubt that efforts to increase environmental flows under the *Living Murray* will actually '…result in net benefit to the community…' (Keogh 2007:34). Such skepticism will, no doubt, increase as more water entitlements are transferred for environmental purposes, and will be even more vociferous at times of low inflows and water storage when seasonal allocations to holders of water entitlements are lower and water prices are higher. Financial pressures will also exist for the CEWH to sell seasonal allocations associated with environmental water entitlements in dry periods. This is because recent modelling suggests that counter-cyclical trading of water (buying and storing water in wetter years and selling it to irrigators in drier periods) by an 'Environmental Steward' may offer cost advantages (Kirby *et al*. 2006).

The merits of the CEWH selling seasonal allocations in low rainfall periods or other forms of trading should depend on the trade-offs between use and non-use. Although some work on these trade-offs has been undertaken (MDBC 2004), there has been very little research on the nature of trade-offs on relevant spatial scales, and how they might vary with the level of inflows. Until, and unless, such studies are undertaken, the CEWH will not be in a position to make informed decisions about its water trading to maximise public benefits. The default in the very recent past has been to accord priority to consumptive uses despite the fact this runs counter to the aims of the NWI. This is illustrated in Table 1 in terms of Victoria's water share on the Murray River. In the past ten years inflows have declined by about a third relative to the long-term average. Although this has resulted in a 10% decline in diversions for consumptive use, environmental flows have fallen by almost one half. This suggests that without a fundamental change to business-as-usual in the Basin, the environment will continue to 'play second fiddle' to water diversions in times of water stress. This is of particular concern as the long-term average inflows into the Murray River are expected to decline with climate change.[3]

3 The expected effect of climate change on inflows varies by catchment in the MDB. In the Goulburn-Broken Catchment of Victoria the best estimate of the reduction in average surface water availability is 14% by 2030 while if the 1997-2006 period climate were to continue average surface water availability would be reduced by 41% over the long-term historical average (CSIRO 2008a). Under a dry extreme climate scenario the average surface water availability for the Murray-Darling Basin as a whole would fall by 37% and for the Murray River by 41% by 2030 (CSIRO 2008b)

Table 1: Inflows, Diversions and Environmental Flows for Victoria's Water Share on Murray River in GL and Percentage Reductions from Long-Term Average

	Total Inflows	Diversions	Environmental Flows
Long-term mean	7,062 GL	1,698 GL	3,946 GL
10 year mean	4,746 GL	1,533 GL	2,221 GL
% Change	-33%	-10%	-44%

Source: Craik (2008).

The TACTIC governance criteria highlight the risk that lack of understanding and incomplete recognition of interdependencies, and the costs and benefits of trade-offs, between use and non-use (Grafton and Peterson 2007) will substantially limit the effectiveness of the CEWH. Transparency about the environmental objectives of the CEWH and its operations relative to measurable goals will also be critical if it is to be accepted by the general public and, especially, holders of water entitlements.

Water for the Future Package

The 2007 *National Plan for Water Security* proposed expenditures approaching $10 billion over 10 years. The outlays for the bulk of this expenditure are set out in Table 2.

Table 2: A National Plan for Water Security

Proposed Expenditure ($ billion)	Amount
Modernising Irrigation in Australia (total)	5.885
- Delivery system efficiency gains	3.13
- On farm efficiency gains	1.635
- Metering, monitoring and accounting	0.620
- Improving river operations and storage	0.500
Addressing Over Allocation in the MDB (total)	3.000
Reforming the MDB Commission (total)	0.600
- Set and administer a new cap	0.100
- MDB Commission operations	0.500
Water Information (total)	0.480
- Modernising and extension program	0.080
- Information management and reporting program	0.120
- Analysis and forecasting services	0.120
- Investigations program and strategic data procurement	0.160
Northern Australia & The Great Artesian Basin (total)	0.085
Total Expenditure Across All Programs	9.450

Source: Department of the Prime Minister and Cabinet (2007).

In the March 2008 MOU all Australian governments endorsed this $10 billion investment and on 29 April 2008 the Commonwealth Minister for Climate Change and Water, Senator the Honourable Penny Wong, announced changes to the allocation of funding and added

additional funds for urban water[4] and retitled the package *Water for the Future*. Under *Water for the Future* there will be a total of $12.9 billion in funding over 10 years designed to secure the long-term water supply across Australia. The package includes $3.1 billion to purchase water entitlements and increase environmental flows in the Murray–Darling Basin and $5.8 billion to improve water efficiency in the Basin over the next 10 years (Wong 2008a). In terms of the buyback of water entitlements, the 2008 Commonwealth Budget forward estimates contain specific allocations for $170.1 million to be spent in 2008-2009 and $482.7 million in 2009-2010 for this purpose. In terms of infrastructure spending, the forward estimates indicate that almost $1 billion will be invested over the period 2008-2010 (Wong 2008b).

The justification for *Water for the Future* is two fold. First, too much water is consumed and not enough is left to maintain healthy river systems. For instance, a 2003 Expert Reference Panel (see Table 3) predicted that without increased flows of 1,630 GL there was only a 'moderate' chance that the Murray River could be returned to a 'healthy' state (Cooperative Research Centre for Freshwater Ecology 2003).

Table 3: Final Summary of Flow Management Options for the Murray River and the Probability of Success

Management Options	Probability of having a healthy working River Murray System
Do nothing more (current operations)	LOW
A. Improved operations	LOW
B. Improved operations plus 350 GL new environmental flows p.a. (Murray source)	LOW
C. Improved operations plus 900 GL new environmental flows p.a. (Basin-wide source)	LOW-MODERATE
D. Improved operations plus 1,630 GL new environmental flows p.a. (Basin-wide source)	MODERATE
E. Improved operations plus 3,350 GL new environmental flows p.a. (Basin-wide source)	HIGH

Source: Cooperative Research Centre for Freshwater Ecology (2003).

The environmental states of river valleys in the Basin over the period 2004-2007, as determined by the Independent Sustainable Rivers Audit, are provided in Table 4. Of the 23 river valleys, 13 are considered to be in a 'very poor' state, seven in a 'poor' state, two in a 'moderate' state and only one in a 'good' state (the Paroo Valley). Second, there is over-allocation of water entitlements of about 25% in the Basin relative to total sustainable yield (National Water Commission 2007:61). Over-allocation is separate to overuse and can contribute to less than desirable environmental flows because government decision makers may be less inclined to reduce water use allocations (or increase environmental flows) in an over-allocated river system because of the costs it imposes on water users (Grafton and Peterson 2007).

4 The funding for urban water includes $1 billion for National Urban Water and Desalination Plan, $250 million for the National Water Security Plan for Cities and Towns, and $250 million for the National Rainwater and Greywater Initiative.

Table 4: Environmental Condition of the River Valleys in the Murray–Darling Basin

River Valley	Condition	River Valley	Condition
Avoca Valley	Very poor	Macquarie Valley	Very poor
Border Rivers Valley	Moderate	Mitta Mitta Valley	Very poor
Broken Valley	Very poor	Murray Valley, Lower	Poor
Campaspe Valley	Very poor	Murray Valley, Central	Poor
Castlereagh Valley	Very poor	Murray Valley, Upper	Very poor
Condamine Valley	Moderate	Murrumbidgee Valley	Very poor
Darling Valley	Poor	Namoi Valley	Poor
Goulburn Valley	Very poor	Ovens Valley	Poor
Gwydir Valley	Poor	Paroo Valley	Good
Kiewa Valley	Very poor	Warrego Valley	Poor
Lachlan Valley	Very poor	Wimmera Valley	Very poor
Loddon Valley	Very poor		

Source: Davies *et al.* (2008).

A major challenge for the *Water for the Future* package is to determine the trade-offs between the costs of actions (such as infrastructure improvements) designed to overcome water problems (such as too much evaporation) with the public benefits (such as larger water flows downstream) of such actions. It also requires careful co-ordination to ensure that investments to improve water-use efficiency are not subsequently followed by the 'wholesale' purchase of water entitlements for the environment in the same location thereby rendering such infrastructure investments redundant (Cullen 2007:5).

Improving water efficiency, that we define as on-farm distribution efficiency — the ratio of water applied to fields as a proportion to water delivered to farm-gate (Madden *et al.* 2007) — may, in some circumstances, reduce environmental flows. This is because water losses in irrigation include not only those attributable to transpiration and evaporation, but also water that would otherwise be returned to the hydrological system via seepage or other means (Productivity Commission 2006). Thus some investments that increase water–use efficiency, such as lining of supply channels, can reduce return flows and exacerbate the overuse of water in the Murray Darling Basin. In response to this risk the *Water for the Future* funding guidelines require that 50% of all water gained through investment in infrastructure by the Commonwealth be returned to the environment. Another key issue in promoting water efficiency gains is that although it may be technically feasible to achieve very low rates of evaporation in irrigation delivery, it could cost more than the alternatives. The point is that improvements in water use efficiency do not necessarily promote the economically efficient use of water — a stated goal of the NWI (paragraph 64).[5] The appropriateness of investing billions to generate system and on-farm water efficiency gains depends very much on the expected returns from such an intervention compared to all available alternatives.

5 Watson (2007, p. 9) has gone far as to describe the approach in the National Plan for Water Security that involves investments in irrigation infrastructure as '…a mirror image of the technology-driven ethos that created those [water] shortages in the first place. This time, however, it is planned to recreate the glories of irrigation on Brownfield sites, instead of Greenfield sites'.

The $3.1 billion in the *Water for the Future* package to buy-back water entitlements held by irrigators in the Murray–Darling Basin greatly expands the $500 million TLM initiative. By contrast to water efficiency investments, the purchase of water entitlements under TLM is currently a cost effective method of water recovery, as shown in Table 5.

Table 5: Estimated Water Cost Savings ($/ML) from Infrastructure Investments

Infrastructure project	Current estimate of the approximate $ per ML of Long Term Cap Equivalent	Reliability of water recovered
Great Darling Anabranch Pipeline	$1,000/ML	High
Coleambally Main Canal – Seepage and Leakage Savings Project	Up to $2,700/ML	High
Shepparton Irrigation Area Modernisation Project	$2,860/ML	High
NSW Wetlands Water Recovery – Stage 1	$2,500/ML	High
Water Recovery from SA River Murray Wetlands – Stage 2: the feasibility of generating water savings and environmental benefits	$4,000/ML	High
Metering accuracy, water use efficiency study and evaluation of infrastructure options for water recovery for the West Corurgan Private Irrigation District in Southern NSW	$5,000/ML	High
Investigation of the potential to recover water by the construction of a 30GL en-route storage 'The Drop' on the Mulwala Canal in the Murray Irrigation Ltd area of operation	>$5,000/ML	High
Ricegrowers' Association	>$2,500/ML	Mix

Source: Socio-Economics Reference Panel of the Murray–Darling Basin Commission (2008).

Substantial purchases of water entitlements by Australian governments, however, could increase the price of water entitlements and, thus, the cost of increasing environmental flows if not carefully managed. At present there are four major market-based water recovery programs in the Murray Darling Basin. Implementation of the buy backs under the *Water for the Future* package thus requires proper co-operation and co-ordination across the jurisdictions. At current prices a mix of general and high security water entitlements could result in the acquisition of up to 1,500 GL from the $3.1 billion set aside for this purpose under the *Water for the Future Package*.[6] By comparison, total annual trades of water entitlements in the southern Murray Darling Basin are a little over 100 GL (Waterfind 2008).

Given the very large quantity of the intended water purchases, governments have used a series of voluntary reverse tenders. Under a reverse tendering system potential sellers offer

6 Substantial purchases of water entitlements will, however, raise the price and thus the expected amount of water recovered will likely be less than 1,500 GL.

specified volumes of water entitlements for sale without knowing what their competitors are offering. This can be in the form of a 'rolling tender' where bids are accepted over short periods (two or three weeks). During this 'open' period successful bidders are contacted to finalise the contract of sale and unsuccessful bidders are informed that the price offered for the water entitlements was too high to be accepted. Subsequently, another 'open' period is set aside to allow for another set of bids including from unsuccessful bidders in the first round. This approach was implemented by the Commonwealth Government in the buyback that began in February and ended in May 2008. Over this period there were 12 assessment periods or rounds in which holders of water entitlements could offer for sale some or all of their holdings through expressions of interest. An alternative to a rolling tender is to allow only one set of bids before an announced closing date and then provide information to those tendering after the tender has closed.

Reverse tenders have worked well in reducing over-capacity in both Australian and overseas fisheries, where holders of fishing permits voluntarily offer to sell their fishing rights to a regulator at a price they choose (Groves and Squires 2007). In such arrangements, the regulator selects those offers of sale that it determines gives the 'best value' based on price and other considerations. In the case of water buy backs, multiple reverse tenders or rounds, as in the 2008 Commonwealth buyback, would probably be required and would also provide flexibility in achieving a mix of goals (Grafton and Nelson 2007). For instance, Australian governments could target their buying to particular locations while also considering socio-economic and environmental objectives, such as accounting for return flows of those selling entitlements.[7] To ensure the cost effectiveness of reverse tenders it would be important not to impose water efficiency conditions or require holders of entitlements to undertake water efficiency investments. This is because such conditions impose cost burdens on prospective sellers that they must recoup in their tendered sale price, thereby increasing the cost of water purchases (Grafton and Hussey 2007).

Governments, to date, have only purchased water entitlements (high and general security) for environmental purposes. The risk in an extreme drought that the Basin is currently facing, and in the absence of an existing large portfolio of high security entitlements for the environment, is that in the short-run there may be insufficient conveyance water retained in the system to allow delivery of allocations to towns, irrigation and other entitlement holders and to provide for emergency environmental watering.

The Basin Plan

The 2011 Basin Plan will include a revised Cap and will regulate both surface and groundwater diversions. An indication of some of the changes that will be required to the existing surface water Cap is provided by the Independent Audit Group (IAG). Since the Cap was established in 1995 the IAG has been providing annual compliance reports on the States to the MDB Ministerial Council. It recommends the following 'refinements' to the Cap as being highly desirable:

- management of groundwater on an integrated basis with surface water within the spirit of the Cap;

7 Water entitlements are denominated as gross flows or diversions and do not account for return flows to the hydrological system (Young and McColl 2003).

- completion of the compliance tools (computer simulation models used to determine cap target diversions) throughout the Basin;
- introduction in each jurisdiction of an appropriate quality management system for the management of metering, monitoring and reporting data;
- development of less restrictive trading rules within and between valleys and jurisdictions; and
- development of a register of agreed Cap definitions (Murray-Darling Basin Ministerial Council 2000:30).

There is a major difference, however, in terms of the proposed cap under the Basin Plan and the existing Cap introduced in 1995. The 1995 Cap was based on the management rules in place at that time. Those rules made more water available in dry years than in wet years. This was consistent with the original purpose of river regulation which was to improve security by providing water during droughts. The new Cap, however, is to be based on sustainability principles. Although providing water during droughts is still one of the primary goals, the protection of the hydrological system as a functioning ecological entity that will continue to support the environment and human society in the medium and longer term is a high priority.

The *Water Act 2007* also created a role for the Australian Competition and Consumer Commission (ACCC). It will supervise water charges and water market rules. The *Water for the Future Plan* also provides hundreds of million of dollars in funding to improve the metering and monitoring of water use. Despite these improvements, significant deficiencies remain. For example, on-farm interceptions and planting of trees have the potential to generate large 'leakages' from the system. So far they are not taken into account by the water trading system under the Basin Plan.[8] Exit fees that inhibit prevent water trading will also remain for several years to come as the ACCC has recommended that rural water suppliers be allowed to impose exit fees until 2015–2016 as a proportion of access fees (Madden *et al*. 2007).[9] In addition to exit fees there still exists a 4% limit on the sales of water entitlements out of irrigation districts that applies to all sales including purchases by governments for environmental purposes.

Another test of the institutional arrangements that will emerge over the next few years will be their capacity to manage environmental water across State borders. If the last few years of low inflows are an indication of what is likely in a future of marked climate change the water sharing arrangements between the States will need to be revised to preserve at least some of the productive and environmental assets of the lower reaches of the Murray River (the Coorong and Lower Lakes). Without some intervention there is a potential for an environmental collapse of the area, in part due to acidification from the exposure of acid-sulphate soils. All the potential responses will involve major costs for both the up–river states and South Australia. In the latter case, serious consideration will need to be given to the consequences of allowing sea water into the Lower Lakes. The alternatives to using sea water all require a very large environmental water allocation that would have to flow passed irrigation communities in dire financial straits. All the options will involve real political pain. Handling the process will severely test the new system.

---

8 At present, the only jurisdiction that accounts for offsets is the lower South–East of South Australia's groundwater system. Anyone who wishes to establish a new plantation of blue gum or pine is obliged to have an irrigation licence that offsets the expected water withdrawal from the plantations (Young 2006).

9 By 2016 exit fees should be no more than eight times the access fee charged by rural suppliers.

Another major concern is the ability of the MDBA and the Basin Plan to allow administrators to adapt to rapid change, especially environmental conditions, within the Basin. If the current extreme conditions continue the transition costs to the environment and resource security of, for example, honouring Victoria's water plans until 2019 will be very high. Climate change, increased water interceptions and afforestation — among other factors will all have substantial impacts on environmental flows and the Basin Plan must be able to adapt quickly to such changes. In addition, improved information and knowledge of the systems, especially about the environmental impacts of reduced flows and water quality, should feed back into overall water planning if public benefits are to be maximised.

Further inflexibility is built into the *Water Act 2007* in terms of who bears the risk about changes in water reliability. Under paragraph 49 of the 2004 NWI, and incorporated into Clause 74 of the Act, governments bear the full risk beyond 2014 for reductions in the reliability of water entitlements in excess of a 3 per cent decline that results from improvements in knowledge about the water systems' capacity to sustain extraction levels or changes in government policy, such as more demanding environmental objectives. The March 2008 MOU confirms this arrangement but increases the Commonwealth's share of any required compensation to 100%. This means that, should the environmental goalposts change, or should the MDBA become better informed about future environmental risks, any private losses associated with these updates beyond a 3% reduction will be borne entirely by society and not by holders of water entitlements. This is peculiar given that water entitlements are statutory rights and runs counter to the notion that holders of property rights must also incur responsibilities for their right to access what is a publicly–owned resource (Fisher 2006). On a practical level, large future reductions in water diversions required for environmental reasons may be delayed or not even implemented because of the direct financial cost it will impose on the Commonwealth to pay compensation.

To promote active adaptive management and responsiveness, holders of water entitlements should bear the risk of long-term environmental change and better knowledge of the consequences of diversions on the environment. Such risk bearing by resource users has worked well in other natural resources. For example, fishers with statutory harvesting rights have comparable rights to water entitlements with a right to harvest fish denominated as a share of the overall total allowable catch (Grafton et al. 2006). Thus, reductions in the overall catch do not trigger compensatory payments. This, in turn, permits managers to focus on setting total catch levels for sustainability independent from the financial costs it imposes on the regulator.

Conclusion

Water security in the Murray–Darling Basin is a national priority. It is an outcome of governance processes that ensures natural and anthropogenic systems are robust to shocks under a wide range of conditions. To help promote water security in the Basin we define six key governance criteria that we collectively call TACTIC: Transparency in governance; Active-adaptive management; Co-operation and effective co-ordination across jurisdictions; Trade-offs between use and non-use and also the use of public funds; Interdependencies across the systems in the Basin; and Capacity (financial and human) to manage the myriad of decisions to achieve water security. Using the TACTIC criteria we assess the most recent water reforms in the Murray–Darling Basin and, in particular, State water plans; the Commonwealth Environmental Water Holder created by the *Water ACT 2007*; the *National Plan for Water Security* and its revamping as the *Water for the Future Package*; and the Basin Plan.

We find that, despite the impressive goals of the 2004 *National Water Initiative* and significant improvements in governance to be implemented in the Water Act 2007 and the COAG March 2008 Memorandum of Understanding on Murray–Darling Basin Reform, much remains to be done to promote water security. We contend that there is currently insufficient transparency about the measurable environmental goals of water reform, inadequate consideration of interdependencies in terms of future environmental watering plans, insufficient rigour in the processes being developed to assess trade-offs in using public funds to promote water security, and in-built inflexibility in the Basin Plan and management structures that will constrain active adaptive management strategies to the detriment of the environment. In addition to these challenges there is an urgent need for substantial investment in human and institutional capacity in water planning and management.

Our conclusion is that, although there have been real achievements, there needs to be much more progress and investment in governance, and institutional capacity, if the current water reforms are to significantly improve water security and to protect bio-physical and socio-economic systems in the Murray–Darling Basin.

References

Blackmore, D (2002) 'Protecting the Future', in D Connell, ed, *Uncharted Waters*. Canberra: Murray Darling Basin Commission.

Blanch, S and T H (2001) 'Backwards looking, downhill going: A critique of the Murray–Darling Basin Agreement (1992)', *Proceedings of the 3rd Australian Water Law and Policy Conference*, Adelaide.

Commonwealth of Australia (2007), *The Water Act 2007*. available at: http://www.envionment.gov.au/ water/action/npws-act07.html

Connell, D (2007) *Water Politics in the Murray-Darling Basin*. Sydney: The Federation Press.

COAG – Council of Australian Governments (2008a) *Agreement on Murray-Darling Basin Reform*, available at: http://www.coag.gov.au/meetings/030708/docs/Murray_Darling_IGA.pdf

COAG (2004) *The National Water Initiative Agreement*, available at: http://www.coag.gov.au/meetings/250604/index.htm#water_initiative

COAG (2008b) *Memorandum of Understanding on Murray–Darling Basin Reform*, available at: http://www.coag.gov.au/meetings/260308/docs/ attachment_a.rtf

Craik, W (2008) 'Issues and Challenges for the MDBC and Going Forward', Paper presented at the 6th Australian Water Summit, Melbourne, March 6.

CRCFE – Cooperative Research Centre for Freshwater Ecology (2003) *Ecological Assessment of Environmental Flow Reference Points for the River Murray System* (Interim Report), Prepared by the Scientific Reference Panel for the Living Murray Initiative, Canberra: Murray–Darling Basin Commission.

CSIRO – Commonwealth Scientific and Industrial Research Organisation (2008a) 'Water Availability in the Goulburn-Broken', available at: http://www.csiro.au/resources/Goulburn-BrokenFactsheet.html

CSIRO (2008b) 'Water Availability in the Murray: Murray-Darling Basin Sustainable Yields Project' available at: http://www.csiro.au/files/files/plos.pdf

Cullen, P (2007) 'Adapting to Water Security: A Global Challenge for the 21st Century'. Paper presented to the New Zealand Freshwater Sciences Society and the Australian Society of Limnology, Queenstown, New Zealand, December, available at: http://www.wentworthgroup.org/docs/Adapting_to_Water_Scarcity.pdf

Davies, P E , J H Harris, T H Hillman and K F Walker (2008) *Sustainable Rivers Audit Report 1: A Report on the Ecological Health of Rivers in the Murray-Darling Basin, 2004-2007*, Prepared by the Independent Sustainable Rivers Audit Group for the Murray–Darling Basin Ministerial Council, available at: http://www.mdbc.gov.au/__data/page/2260/SRA_Report_1_June2008_small.pdf

Department of the Prime Minister and Cabinet (2007) *A National Plan for Water Security*, available at: http://www.environment.gov.au/water/publications/action/npws-plan.html

Fisher, D E (2006) *Implementing The National Water Initiative: A Generic Set of Arrangements for Managing Interests in Water*. Kelvin Grove: Queensland University of Technology Publications and Printing and Phillips Fox Lawyers.

Grafton, R Q, R Arnason, T Bjorndal, D Campbell, H F Campbell, C W Clark, R Connor, D P Dupont, R Hanneson, R Hilborn, J E Kirkley, T Kompas, D E Lane, G R Munro, S Pascoe, D Squires, S I Steinshamn, B Turris, Q Weninger (2006) 'Incentive-based Approaches to Sustainable Fisheries', *Canadian Journal of Fisheries & Aquatic Sciences* 63.

Grafton, R Q and K Hussey (2007) 'Buying Back the Living Murray: At What Price?', *Australasian Journal of Environmental Management* 14:2.

Grafton, R Q and H W Nelson (2007) 'The Effects of Buyback Programs in the British Columbia Salmon Fishery' in R Curtis and D Squires, eds, *Fisheries Buybacks*. Ames, Iowa: Blackwell Publishing.

Grafton, R Q and D Peterson (2007) 'Water trading and Pricing' in Karen Hussey and Steve Dovers, eds, *Managing water for Australia: The social and institutional challenges.* Melbourne: CSIRO Publishing.

Groves, T and D Squires (2007) 'Lessons from Fisheries Buybacks' in Rita Curtis and Dale Squires, eds, *Fisheries Buybacks*. Ames, Iowa: Blackwell Publishing.

Kellow, A (1995) 'The Murray-Darling Basin', in Timothy Doyle and Aynsley Kellow, eds, *Environmental Politics and Policy Making in Australia*. Melbourne: Macmillan.

Keogh, M (2007) 'What will be the Value of Environmental Benefits Arising from Water Reform', *Farm Policy Journal* 4:3.

Kirby, M, M E Qureshi, M Mainuddin and B Dyak (2006) 'Catchment Behavior and Counter-Cyclical Water Trade: An Integrated Model', *Natural Resource Modeling* 19:4.

Madden, J, J Knowles and A Buckingham (2007) 'Investing in the Modernisation of Irrigation Infrastructure: The Challenges and Opportunities for Government and Agriculture', *Farm Policy Journal* 4:3.

Marsden Jacob Associate (2005) *Audit of Murray–Darling Basin Cap Data Management Systems*. Canberra: Murray–Darling Basin Commission.

MDBC – Murray–Darling Basin Ministerial Council (2001) *Integrated Catchment Management in the Murray–Darling Basin 2001-2010: Delivering a sustainable future.* Canberra: Murray–Darling Basin Commission.

MDBC (2002) *Annual Report 2001-2002*. Canberra: Murray–Darling Basin Commission.

MDBC (2004) *The Living Murray: Scoping of Economic Issues in the Living Murray, with an emphasis on the irrigation sector.* Canberra: Murray–Darling Basin Commission.

MDBC (2008a) 'Icon Sites', available at: http://thelivingmurray.mdbc.gov.au/iconsites

MDBC (2008b) 'Murray System Drought Update, Issue 13, available at: http://www.mdbc.gov.au/__data/page/1366/Drought_Update_Issue_13_-_May_2008.pdf

National Water Commission (2007) *Level 2 Baseline Assessment of Water Resources for the National Water Initiative*, Canberra: National Water Commission.

Productivity Commission (2006) *Rural Water Use and the Environment: the role of market mechanisms*. (Research Report), Melbourne: Productivity Commission.

Quiggin, John (2006) 'Urban water Supply in Australia: the option of diverting water from irrigation,' *Public Policy*, 1:1, 14-22.

Stoeckel, K and HAbrahams (2007) 'Water reform in Australia: The National Water Initiative and the role of the National Water Commission' in K Hussey and S Dovers, eds, *Managing water for Australia: the social and institutional challenges*. Melbourne: CSIRO Publishing.

Socio-Economics Reference Panel of the Murray–Darling Basin Commission (2008) *Brief Assessment of the Merits of Purchasing Water Entitlements during a Time of Low-Water Availability*. Canberra: Murray–Darling Basin Commission.

Waterfind (2008) 'Waterfind Analysis of the Federal Government Buyback June 2008,' available at: http://www.waterfind.com.au/docs/WaterfindBuyBackAnalysis.pdf

Watson, A (2007) 'A National Plan for Water Security: Pluses and Minuses', *Farm Policy Journal* 4:3.

Wong, Senator the Honourable Penny (2008a) 'Media Release 29th April – Rudd Government to Invest 12.9 Billion in Water', available at: http://www.environment.gov.au/minister/wong/2008/pubs/mr20080429.pdf

Wong, Senator the Honourable Penny (2008b) 'Media Release 13th May – $400 Million Brought Forward to Act on Murray-Darling', available at: http://www.environment.gov.au/minister/wong/2008/pubs/budmr20080513e.pdf

Working Group on Climate Change and Water (2008) *Report to Council of Australian Government March 2008*. Canberra: Council of Australian Government, available at: http://www.coag.gov.au/meetings/260308/docs/CCWWG_water_report.pdf

Young, M (2006) 'Droplet Number 3: Undermining Water – Accounting for Flow Reducing Activities', available at: http://www.myoung.net.au/water/droplets.php

Young, M and J C McColl (2003) 'Robust Reform: The Case for a New water Entitlement System for Australia', *The Australian Economic Review* 36:2.