Sustainability and the National Water Initiative

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This previously unpublished study was undertaken in 2006/7 with funding support provided by Land and Water Australia. (Its working title was ‘The Sustainability of Sustainable Limits to Extractions – informing the National Water Initiative’). The focus of the paper is on the debate about how best to introduce sustainable water management in Australia based on cases studies in the Northern Territory, Victoria and South Australia. The policy and institutional settings that provided the context of the paper remain essentially unchanged and the questions it addressed are still unresolved. It is being published at this time as a contribution to the public debate that will ensue with the release of the draft Murray Darling Basin Plan, prior to its finalization in 2011.

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Executive Summary

This project was developed to assist with the implementation of the National Water Initiative. The NWI is designed to reduce conflict and protect the security of water resources by creating a robust framework for the management of competing demands. Its central organising device is comprehensive water plans. The process of developing and implementing water plans is to result in compromises between all the competing interests. This is to take place within the wider context provided by the requirement that the management system that results from the negotiating process will ensure that the environmental condition of the water body in question will be environmentally stable at whatever level of modification has been agreed upon. The definition of environmental sustainability is to be determined by a community political process that takes full account of social, economic and environmental issues.

The NWI was intended to provide a framework that would result in systems of water management within which:

- allocations would be restrained at levels that would achieve or preserve environmental sustainability at the agreed level of modification (at the very least stability of environmental condition and resource security)
- there would be clearly defined water entitlements that could be legally defended, and
- the rules applying to decision making and management would be transparent so that stakeholders know what to expect under a wide range of predictable circumstances (thereby eliminating most of the scope for discretionary decision making previously exercised by agency water managers and government ministers).

Definition of environmental sustainability

Central to this process was the development of a definition of environmental sustainability that could underpin water planning. Implicit in the NWI are three minimal criteria that need to be met for a modified environmental system to be defined as environmentally sustainable. First, the level of environmental sustainability should be stable, durable and maintainable over a reasonable period of time and not in a state of continuing decline. Second, the condition of environmental sustainability would need to be system-wide. This is made clear in many sections of the NWI. It requires ‘the return of all currently over allocated or overused systems to environmentally sustainable levels of extraction’ and ‘recognition of the connectivity between surface and groundwater resources and connected systems managed as a single resource’. Similarly, the planning framework is to ‘implement firm pathways and open processes for returning previously over allocated and/or overdrawn surface and groundwater systems to environmentally sustainable levels of extraction’. Third, the level selected as the appropriate degree of modification would need to be politically viable for a reasonable length of time.
Project aims

To assist the national-wide process of defining environmental sustainability and developing water plans this Land and Water Australia funded project was designed to:

- examine the concepts of environmental sustainability being developed in three contrasting catchments (to be drawn from three jurisdictions),
- value add by drawing on the literature that discusses environmental sustainability, and
- then reinject its observations about environmental sustainability back into the public debate in ways that would contribute to the overall national effort to define the concept.

The three catchments that were examined as part of the project are the Daly River in the Northern Territory, the Goulburn Broken rivers catchment in Victoria and the South Australian section of the Murray-Darling Basin.

Goulburn Broken Catchment Victoria

Goulburn Broken is a major catchment in the southern headwaters of the MDB that supplies 11 percent of the flow of the River Murray. Flow patterns are dominated by releases from Eildon Dam. The catchment supports a wide range of agricultural activities and a number of substantial regional cities such as Shepperton and Benalla. The catchment is highly modified but it contains a number of major environmental assets. Best known is the Barmah Forest a large red gum dominated region which is registered as a Ramsar International wetland.

Environmental degradation through the catchment is widespread as a result of extensive clearing of native vegetation and reduced flows and changed seasonal patterns of flow due to extractions for irrigation. A majority of the streams are environmentally degraded. The clearing of native vegetation over the past century has resulted in high water tables across much of the landscape and extensive dryland salinization. There has also been a rapid expansion in recent years in plantation forestry and in the number and size of farm dams. Although these activities are causing significant reductions in the volume of inflows into streams they are outside of the existing system of water management.

Water management in the catchment is divided between Goulburn Murray Water and the Goulburn Broken Regional Catchment Authority. The former supplies water to irrigators, industry and urban centres etc according to their entitlements and the latter conducts a substantial and wide ranging environmental remedial program with often ambitious targets based on detailed scientific assessments of stream health. Typically this involves part funding of projects put forward or developed in cooperation with groups such as Landcare and with individual land and water managers. This is backed up by a very active program of community education that increases knowledge of environmental issues and encourages support for voluntary involvement in remedial projects.
The activities of Goulburn Murray Water and the Goulburn Broken CMA come together at the level of the Victorian Minister for Sustainability and the Environment who is in a position to alter the balance between extractions and environmental flows as part of the reassessment which take place every fifteen years and to increase or decrease the funding and shape the priorities of the plans of the CMA. The plans and strategies of the CMA also reflect extensive community consultation. This involves discussion of desired futures for the region and potential targets for projected activities. It does not, however, involve detailed discussion about potential trade-offs between the overall level of extractions and potential level of modification or degradation. Although community values are taken into account that debate remains the preserve of the minister.

As with other Victorian catchments the Goulburn Broken catchment has no overall plan that coordinates extractions and remedial activities based on the principle of protecting or restoring ‘environmental sustainability’. As has been the case since it was established in the late nineteenth century, at the core of the Victorian system is the discretionary decision making power of the minister. The overall water management system in place in Victoria may or may not be better than that contained in the NWI. To make an informed judgement about that question would require considerable debate and research. What is clear, however, is that it is fundamentally different both in its approach and underlying principles.

**Daly River Northern Territory**

The Daly river catchment is at the centre of the debate about whether or not Australia should massively expand irrigation in the north in response to climate change. It is considered the most suitable for irrigation development in the Northern Territory. Not only is it one of the few rivers in that region with a summer flow, it averages about fives times that of any other stream. There are no large potential dam sites in the catchment, however, so any expansion of extraction will come from groundwater or direct from the river itself. Across the catchment groundwater aquifers intersect with the land surface in many places resulting in a mosaic of hundreds of swamps, springs and wetlands that persist through the dry season, a highly distinctive feature of the region.

The catchment supports a range of stakeholders. Particularly significant are the indigenous community, the tourist industry, recreational fishers along with the relatively small irrigation industry based around the town of Katherine. In the early 2000s there was a relatively unsatisfactory consultation process that was eventually aborted. In its place the Northern Territory government imposed a moratorium on land clearing, an activity closely associated with proposals for expanded irrigation, and created an alternate planning process within which community consultation was much more circumscribed. A development plan for the catchment is due to be released in the near future.

The conflicts between the various stakeholders appear very stark. On the one hand the groundwater aquifers underlying the region are large and if irrigation was made a priority large scale extractions would be possible. However it appears that even low levels of extraction will have devastating impacts on the water-based environmental values that support the indigenous community, tourism and recreational fishing. The
wetlands across the region result from the aquifer being full and in contact with the land surface for most of the dry season. Even an apparently ‘moderate’ rate of extraction that lowered the groundwater level only marginally would cause them to dry up.

In addition, summer flows in the Daly would be seriously reduced if a large groundwater based irrigation industry developed. This would have major impacts on its ecological function both along its course impacting on highly significant species such as the pig nosed turtle and downriver where barramundi fishing is important. It is hard to see how these conflicting interests can be accommodated. The water management plan for the Daly River catchment that will eventually be approved will almost certainly be largely the product of negotiations between the Northern Territory and the Commonwealth governments.

South Australian Murray-Darling Basin

In the MDB the three upriver States each have a section of the top part of the basin (Victoria in the south, New South Wales in the east and Queensland in the north). Water flows from those States into South Australia with the bulk of flows coming from Victoria and New South Wales. As a result riverine conditions in South Australia reflect the cumulative impacts of activities in all three top basin States as well as in the State itself. This means that compared with its neighbours, South Australia the end-of-system State, is potentially more exposed to the cumulative impacts of growing development pressure, much of it in areas controlled by other jurisdictions. The National Water Initiative requires a whole-of-system approach to water management. So far however, none of the sub MDB water management regions used for detailed implementation give priority to biophysical interrelations that cross state borders.

The gap between the principles of the NWI and the existing institutional arrangements in the MDB is well illustrated by considering the following scenario, implementation of which is now being seriously considered by Victoria and New South Wales. The difference between South Australia’s regular entitlement of 1850 gigalitres, as specified in the MDB Agreement, and the average flow over the border of just under 5000 gigalitres is very substantial. While the Cap process limits the volume of water that can be used for human consumption, industry and agriculture, there is nothing in the MDB Agreement or other agreed policies that requires the two upper states to deliver more than the minimum at the border. This means that the very large difference of approximately 3000 GLs between the two flow figures could be used for environmental purposes in New South Wales and Victoria.

Taking a Basin-wide perspective the potential benefits in the upper parts of the catchment may well out weigh the costs to the lower reaches but the institutional arrangements now in place in the MDB mean that this scenario will not be subjected to the discipline of such a test. Veto by any one jurisdiction, either Victoria or New South Wales, would keep the issue off the agenda of the Ministerial Council. The lack of a comprehensive basin wide framework as shown by this issue significantly

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1 This figure is based on flows over the past century. There has been almost no flow out of the Murray Mouth in recent years.
undermines the potential effectiveness of the efforts to implement integrated catchment management in South Australia.

Conclusion

The National Water Initiative is based on the imperative to define and implement management for environmental sustainability that will protect resource security as a prerequisite for establishing strong property rights. Failure to define ‘environmental sustainability’ means that implementation of the NWI cannot begin. In practice, the material gathered through this project suggests strongly that Australian water management is still based on the assumptions and patterns of behaviour that were dominant before the NWI was approved.

Consequently the system is still dependent on government ministers exercising substantial discretion in response to the frequent unpredictable crisis that result from the instability created by over allocation. Consequently this project recommends that a more thorough and wide ranging study is needed to investigate the situation in all jurisdictions and:

reveal the many ways in which pre NWI assumptions and patterns of water management are still dominant in practice,

and explain in detail the changes required before the process of implementing the NWI can commence.
Establishing a context

- Irrigation worldwide has created dependencies that it will be difficult to maintain.
- Environmental sustainability is essential for long term resource security.
- The debate about how to achieve environmental sustainability in the field of water management is just one element of a wide debate about how to achieve a sustainable society.
- Hydrological systems like other environmental systems should be managed with a systems perspective so that the full range of factors that affect outcomes can be taken into account.
- Australian hydrological systems are currently managed as open access resources without an overall institutional framework to restrain growth in demand short of the collapse of resource security.
- Sustainability issues have a high degree of complexity that poses difficult challenges to policy making and management.
- Environmental management must give a high priority to avoiding threshold changes.

This project was developed to assist with the implementation of the National Water Initiative. The NWI is designed to reduce conflict and protect the security of water resources by creating a robust framework for the management of competing demands. Its central organising device is comprehensive water plans. The process of developing and implementing water plans is to result in compromises between all the competing interests. This is to take place within the wider context provided by the requirement that the management system that results from the negotiating process will ensure that the environmental condition of the water body in question will be "environmentally stable at whatever level of modification has been agreed upon. The definition of environmental sustainability is to be determined by a community political process that takes full account of social, economic and environmental issues.

To assist the national-wide process of defining environmental sustainability and developing water plans this project aimed to:
- take the concepts of environmental sustainability being developed in three contrasting catchments (to be drawn from three jurisdictions),
- value add by drawing on the literature that discusses environmental sustainability, and
- then reinject its observations about environmental sustainability back into the public debate in ways that would contribute to the overall national effort to define the concept.

The three catchments are the Daly River in the Northern Territory, the Goulburn Broken rivers catchment in Victoria and the South Australian section of the Murray-Darling Basin.

A number of assumptions underpinned the project. At the time of submission to Land and Water Australia for funding in mid 2005 it was assumed that in the near future if not already the eight jurisdictions (excluding the Commonwealth) who are signatories to the National Water Initiative would:
begin the process of developing statutory water plans for all significant hydrological systems subject to modification across Australia according to the specifications agreed to in the NWI,
create institutions with the capacity to involve the community in the process of defining the assumptions and goals that would be the core of the water plans and,
invest considerable effort in defining environmental sustainability, given that such a definition is meant to the cornerstone of the water plans to be developed to implement the NWI.

These assumptions have proved incorrect. Although considerable activity is taking place in all three catchments that are described here that are designed to improve or slow the decline of the environmental condition there is no real debate about the meaning of the concept ‘environmental sustainability’. This statement also appears correct from a national perspective.

The National Water Initiative is based on the imperative to define and implement management for environmental sustainability as a prerequisite for establishing strong property rights. Failure to define ‘environmental sustainability’ means that implementation of the NWI cannot begin. In practice, the material gathered through this project and other activities suggests strongly that, despite the rhetoric and frequent reference to the NWI, Australian water management is still based on the assumptions and patterns of behaviour that were dominant before the NWI was approved. There is, however, very little recognition by governments or the public of this situation or its dire implications for the future of Australia’s water resources.

Consequently this report concludes that a more thorough and wide ranging study that investigates the situation in all jurisdictions is needed to:

- reveal the many ways in which pre NWI assumptions and patterns of water management are still dominant in practice,
- and (drawing on a considerable body of existing work) explain in considerable detail the changes required before the process of implementing the NWI can start.

**Dilemma of contemporary water management**

Some of the greatest dilemmas facing contemporary water managers stem from the enormous benefits gained in the recent past. These have created dependencies that it will be difficult to maintain. The additional agricultural productivity made possible by irrigation development allowed a large increase in the world’s population over the last century. According to the United Nations Development Program, irrigated land currently provides about a third of total food supply. Without it, population could not have expanded as it has. Of even greater concern, nearly all the additional food that will be needed to support the projected population growth in coming decades will have to come from expanding irrigation².

² Postel, S., 1999, *Pillars of Sand: can the irrigation miracle last?*
But irrigated agriculture is already failing to keep up with demand. The area of irrigated land has increased faster than population growth for most of recent history but according to the United Nations Development Program that trend has been reversed since about 1978. Irrigated land is increasing at about 1 percent a year while global population is expanding at an annual rate of about 1.6 percent. Worse, one out of every ten hectares of irrigated land is losing productivity due to water logging and salinisation and many irrigated regions are only maintaining production by pumping from groundwater at rates faster than the rate of recharge. In the short term increased productivity will partially redress the deficit but it cannot be a long-term solution with out sustainable patterns of consumption.

The threat to human security posed by environmental decline and reduced access to freshwater resources has been recognized by a succession of United Nations conferences. The Mar del Plata Conference in 1977 stated that ‘water accessibility and scarcity increasingly threaten four fundamental aspects of human security – food production, human health, the health of the aquatic environment and social, economic and political stability’. These themes were developed further by a United Nations commission headed by the Norwegian Prime Minister Gro Harlem Brundtland. Its findings were released in 1987 in *Our Common Future* better known as the Brundtland report. It argued that a comprehensive approach to international and national security must take into account the potential impacts of unsustainable development.

After describing how environmental decline can exacerbate a wide range of social, economic and political stresses, the Brundtland report highlights the environmental component of some of the worst human welfare disasters in the preceding decade and put forward what is now the most widely used definition of sustainable development. It proposed that the aim should be to satisfy ‘the needs of the present without compromising the ability of future generations to meet their own needs’. The Brundtland formulation of the concept of sustainability requires acceptance of the reality that there can never be a stable long-term goal that can be described as the ‘environmentally sustainable’ target. People must maintain a state of constant alertness about the potential long-term impacts of their activities, adjusting continually to new knowledge as it comes available. Implicit is the requirement that a society should be able to generate and use new knowledge and periodically undertake a fundamental reassessment of major activities previously thought acceptable. It is not possible to make all-encompassing statements about the future needs of other people, or the long-term consequences of contemporary actions. So the Brundtland definition defines sustainability in terms of cultural capacity to adjust rather than as a set of static relations with the biophysical world that can be reached and maintained without continual reassessment.

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3 United Nations Development Program, ‘Principal challenges associated with water resources, Chapter 2.


4 United Nations Development Program, ‘Principal challenges associated with water resources’.


Growing acceptance of the imperative to continually adapt to changing circumstances is part of the world-wide reassessment of the extent to which humans can control and direct complex socio-ecological systems. In western societies the loss of faith in the effectiveness of command and control systems based on central planning for social and economic goals, has been paralleled by the beginnings of a similar reassessment in natural resources management. There is now more emphasis on the benefits of adapting to natural systems rather than attempting to rigidly control them. Restoration of floodplains rather than higher embankments is increasingly seen as the better way to manage flooding. Similarly it makes more sense to preserve ecosystem services such as wetlands to improve water quality rather than resort to technological substitution such as water purification.

The importance of protecting riverine environments has long been supported on aesthetic and moral grounds but economic arguments are also being put forward on their behalf. Many benefits are provided by biophysical systems that are able to maintain their capacity to function as ecological systems. Water purification for human consumers has already been mentioned. The prevention of algal blooms is another. Well-vegetated riparian areas also stabilise riverbanks and reduce erosion, protect farmland and structures such as roads and bridges and improve conditions for fish and other forms of life. Water based environments are of great importance for tourism and recreation and have a major influence on decisions about where people will choose to live. In addition, the costs of attempting to rehabilitate areas that have been degraded are often extraordinarily high, frequently far exceeding the value of any short-term economic benefits gained from their degradation.

Environmental sustainability is not an optional extra to be sought only if it does not threaten short-term economic productivity. World-wide the consequences of not developing more sustainable water management systems that will continue to be productive, is going to be extraordinary misery for billions of people. Many are already in that condition. The Earth Summit at Rio De Janeiro in 1992, added to the momentum building for the introduction of holistic water management – integrated catchment management – that can better preserve the environment and prevent the erosion of security of supply for water as a resource underpinning economic development. The Murray-Darling Basin Initiative developed in the 1980s was a precursor to this international effort and an example of Australia’s leading role in developing this approach. More recently, commitment to these principles has been reflected in the 1992 National Strategy for Ecologically Sustainable Development, the Council of Australian Governments’ 1994 rural water reform program and in 2004, the National Water Initiative.

Proposals to introduce environmentally sustainable water management in the MDB are part of a wider program to implement sustainable environmental management throughout society in general. Assessing achievement nation-wide in 2002, however, a decade after Australia governments adopted the National Strategy for Ecologically Sustainable Development, David Yencken and Debra Wilkinson concluded that there has been very little real progress. They gave six reasons why current policies will not achieve ecological sustainability. Policies are not comprehensive in view of the problems identified, they are inadequately resourced, the legislative and administrative base for effective action is weak, pressures on the environment are being allowed to grow, the monitoring systems needed to identify problems and
assess efforts at remediation have not yet been put in place, and there have been very few significant successes so far\(^7\). That assessment of the national situation in general is also apt as a description of water management in particular.

Dissatisfaction with the slow speed of reform caused the Commonwealth and state governments to adopt the National Water Initiative (NWI) at the June 2004 meeting of the Council of Australian Governments (CoAG). The NWI is goal orientated in its approach to change, a so-called stretch strategy. The oft quoted example is President Kennedy’s decision to put a man on the moon. Approval of the NWI means that a stretch strategy for Australian water management has now been endorsed at the highest political level. Whether that commitment can be made real will now be tested.

**Water - a tragedy of the commons?**

It has proved very difficult to properly take account of the nature of water as a multi-use resource. The process of defining water as an object of management is made complex by its relationship with human society. Pressure to treat water entitlements as a commodity that can be owned and managed like land is strong but leads to great confusion. A comparison between the two reveals profound differences. In broad terms land stays in one place and its physical dimensions can be defined. Water, however, is like air, which is re-cycled from people to plants to other people and so on. A specific water molecule could typically progress from the atmosphere to a stream where it provides an environment for flora and fauna. At different moments it could support water sports, water a crop, become groundwater seepage that carries salt onto the property of a neighbour or part of a return flow to the streams that drain the landscape. Eventually it could reach an estuary where the maintenance or non-maintenance of pre-development levels of flow of fresh water into the sea has dramatic effects on fish breeding and the economic viability of coastal towns. One of the questions for contemporary society and water policy makers is to what degree is it appropriate to give some of the users involved in this progression, but not others, property rights to the water they so briefly control?

In 1968 Garrett Hardin published a short paper titled *The Tragedy of the Commons* in which he argued that it was difficult to restrain over exploitation of common resources such as shared pastures, fish and water\(^8\). Critics subsequently nominated many examples of successful management of natural resource systems owned in common and suggested that his thesis was more applicable to open access resources which lack any effective overarching institutional framework able to control and regulate the behaviour of would-be users as a group. In the case of an open access resource it is in the interests of each individual user to expand their own consumption indefinitely because any restraint will only increase the volume available for their competitors. The eventual result is the complete destruction of the resource to the disadvantage of everybody.


\(^8\) Hardin, G., 1968, ‘The Tragedy of the Commons’. 
Few Australian hydrological systems are subject to comprehensive management frameworks. As a result in most regions water is an open access resource with all the risks that implies. The governments responsible for protecting the interests of their people have not yet succeeded in establishing effective institutional processes that can protect it from continuing degradation and reduction. Some indication of what is involved is provided by a list of characteristics typical of environmental issues such as sustainable water management, compiled by the policy analyst Stephen Dovers. He argues that they make environmental sustainability problems fundamentally different from other policy issues. They occur over much longer time scales and often cut across established administrative boundaries. Poorly defined but finite limits are common but it is difficult to take them into account within economic systems committed to the reducing restraints on short-term growth. Environmental systems are frequently subject to thresholds that result in significant loss when they occur but which are hard to predict and difficult to reverse. There is great uncertainty about the likely effects of policy choices when the benefits can be very long term. Many impacts are cumulative and interact with each other and long established patterns of management can suddenly produce very different results compared with the past. Even more problematic, as the level of anthropogenic pressure grows, it is difficult to take account of ethical and moral considerations created by the conflicting demands of different sections of society.

The sheer novelty of sustainability problems makes them difficult to handle within traditional modes of management and governance. For political parties, contemporary water management create divisions that ignore traditional party lines. Robust criteria for determining whether particular water policy issues should be treated as public or private are hard to develop and maintain. A significant underlying factor fuelling the growing crisis is that the predictive capacity of traditional science continues to be limited. Trends and general bio-physical processes can be documented at the larger scale but it is often difficult to identify the links between particular actions and specific consequences with enough certainty to give managers, the courts and the people who will be affected by their decisions, confidence in the process or the results. The economic system has a low capacity to penalise those who are responsible for negative environmental impacts or to provide rewards to those who incur extra costs by adopting more sustainable management practices. Despite the growing interest in the so-called triple bottom line approach, accounting systems are ineffective in capturing the environmental/social costs and benefits involved. The legal system is frequently unable to penalise those people responsible for negative environmental impacts and the potential benefactors of remedial action often cannot be identified clearly enough to target the collection of costs. All in all, it is questionable whether much progress has been made in the effort to formulate problems in ways that lend themselves to the negotiation of effective solutions that can be implemented by existing institutions.

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Ultimately, if they are to be accepted, laws and regulations need to take account of the biophysical characteristics of water and the varying relationships that different people and interests have with it. Whether considered from an expansive or a utilitarian perspective, water is integral to the religious and cultural identity of many people, ranging from Indigenous Australians, Hindus, Moslems, Buddhists and Christians, to devotees of Gaia and others who just like the view. In addition, given that water is essential for life, many people insist on defining access to it as a right rather than a commodity. Any attempt to control and manage such an element is always going to be politically contested.

Management of common resources

Attempts to create regulatory regimes that will promote multiuse of natural resources by different agents operating in the same geographical space are not new. The use of leases in relation to land, which dates back to the early nineteenth century in Australia, is just one example of the way in which governments can implement management policies with a multiple of objectives. The early pastoral leases were designed to protect long established Indigenous hunting rights while allowing pastoralism at the same time in the same areas. A more recent example of policy designed to balance competing objectives – in this case environmental protection and timber based industry – is the Regional Forest Agreement (RFA) process. Disputes about forests have caused serious political difficulties in Australia, particularly for Labor governments, not least the national Labor Government between 1983 and 1996. Among the protagonists are forestry industry workers and environmental groups, both long established supporters of that party.

RFAs are meant to protect forest areas of high conservation value and provide the timber industry with security of supply: a combination of aims very similar to those of the NWI. Eventually the RFAs lost credibility with environmental groups who have increasingly focussed their efforts on other options for political action. Establishing a credible process that can balance environmental and production interests has proved difficult. There has also been a failure to effectively involve regional communities and state governments, although often sympathetic to production interests, have been unable to protect the security of supply for timber companies in the face of growing public anger. They also failed to satisfy their environmental critics resulting in an increasingly polarised debate. This history highlights the great difficulty involved in achieving such compromises and indicates some of the dangers that can result from failure to effectively manage politically contentious environmental issues.

Fish are another resource that has many of the characteristics of water. The NWI states that in a given hydrological system the consumptive pool available for diversion is the water left over after sufficient provision has been made to maintain environmental sustainability at whatever level of modification has been agreed in the negotiations required to prepare the water plan. The water resource is obviously finite but it is very hard to define its size, not least because it varies from year to year. It is also difficult to fine tune management given the long lead times between actions and consequences. Failure to successfully juggle the variables involved, however, leads to environmental decline, erosion of resource security and in many cases threshold changes that are difficult to predict or reverse.
Managers of fish stocks have to grapple with similar issues. The size of the resource is hard to calculate. In many cases little is known about the reproductive patterns or habitat requirements. Just as it is difficult to establish the size of the consumptive pool of water and protect environmental sustainability, defining a sustainable level of fishing is often only done after the event when collapse has shown that exploitation was too extreme. Given the level of available biophysical knowledge the precursors to such events are often not easy to pick. This makes fish stocks extremely prone to over-exploitation because it is hard to set limits that can be sustained in the face of strong political pressure.

In the field of water management there is increasing interest in the use of property instruments to give incentives to the holders of water entitlements to manage the resource sustainably. This normally involves proposals to create a package of rights and responsibilities that will shape management behaviour. The aim is to un-lease the enormous energy that can be created by self-interest and at the same time direct it so that the result benefits society as well as the individual. That is easy to state but difficult to execute. For water managers just beginning to grapple with these issues fish stock management has many useful lessons. That field has been experimenting with this approach for a number of decades. A wide range of variations have been trialled and their successes and failures are well documented.

In essence the core subject is human behaviour under different patterns of rewards and constraints, not water or fish management. Placing water management alongside forest and fish management draws attention to underlying continuities and commonalities. The evolution of all three in recent years involves the development of the sort of cultural values that are central to many definitions of sustainability. There is growing awareness of the importance of placing issues in the context of ecological systems and thinking beyond merely the protection of iconic species or trees. The precautionary principle is receiving increasing attention and the social processes through which compromises are made about policy goals are pushing beyond simple trade-offs between powerful interest groups. Most generally recognition and analysis of similar developments in a number of different areas of natural resources management encourages people to develop a more conceptual understanding of the processes in which they are involved. That in turn makes it easier for them to be flexible and open to innovation in response to new policy options.

Water management part of the Australian settlement process

The difficulties involved in implementing sustainable water management are part of the larger challenge involved in achieving sustainable management of natural resources in general. An early example of the difficulties facing Europeans attempting to adjust to Australia’s climate and environment was the expansion of the northern frontier for wheat farming in South Australia in the 1870s and 80s. This episode resulted in one of the first major public policy debates about the implications of climate variability for the Australian settlement process. During the 1870s, settlers pushed into northern South Australia to establish wheat farms against the advice of

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the Surveyor General, George Woodroffe Goyder, who warned that the droughts of the 1860s would return, which they did. Forced to retreat, the settlers left behind a degraded landscape littered with ruined buildings that can be seen to this day.

Although this story figures large in the history of South Australia the historian Janis Sheldrick has been argued that Goyder’s advice is still misunderstood. Both at the time and since it was widely assumed that the line that Goyder drew demarking the recommended limits of farming was based on information collected about the average rainfall in different parts of the state. Instead, she suggests, he was really trying to explain the risks created by climate variability rather than aridity, a more subtle concept that settlers accustomed to the regular seasons of Europe were culturally ill-equipped to understand and one which still confounds their descendents today. The story of Goyder’s line is usually presented as a tragic but colourful historical event that illustrates the ignorance of the pioneers but has little significance for contemporary Australians. Arguably, however, a similar struggle between biophysical realities and human ambition is under way in the MDB where the process of landscape and stream modification has proceeded apace in recent decades largely oblivious of the need for caution or the possibility of threshold changes to its ecological systems.

The danger of threshold changes in natural systems, particularly when they result from increased development pressure, is now well recognised worldwide. A report dealing with this issue was released early in 2005 by the Millennium Ecosystem Assessment project. Commissioned by the United Nations and summarising a vast volume of research, the report put forward a number of general propositions that need to be taken into account by governments and environmental management agencies:

Different categories of ecosystem services tend to change over different time scales, making it difficult for managers to evaluate trade offs fully. The inertia of various direct and indirect drivers differs considerably, and this strongly influences the time frame for solving ecosystem-related problems once they are identified.

Significant inertia exists in the process of species extinctions that result from habitat loss: even if habitat loss were to end today, it would take hundreds of years for species numbers to reach a new and lower equilibrium due to the habitat changes that have taken place in the last centuries.

Nonlinear changes, including accelerating, abrupt and potentially irreversible changes, have commonly been encountered in ecosystems and their services.

On balance, changes humans are making to ecosystems are reducing the resilience of the ecological components of those systems. Once an ecosystem has undergone a nonlinear change, recovery to the original state may take decades or centuries and may sometimes be impossible.

These are long established principles in the field of ecology and in that sense nothing new but in practice they are rarely typical of Australian water management programs. Together they indicate the need for larger investment in research to improve understanding of complex systems and more attention to the precautionary principle.

Prominent among researchers working on these issues is an international group of social and natural scientists known as the Resilience Alliance. This includes Buzz Holling, Lance Gunderson, Elinor Ostrom and in Australia, Nick Abel and Brian Walker. They have attempted to develop a conceptual framework that will improve understanding of the way in which complex socio-ecological systems respond to disturbance, in particular pressures from intense economic development. This has led to a focus on the role of resilience in ecological systems and the need to promote it. Central is attention to the significance of thresholds that can result in irreversible shifts when key controlling processes are eroded. The result of crossing such thresholds, they argue, is likely to be ‘less resilient ecosystems, more rigid institutions and deeper social dependencies’. An example of what can happen when a society becomes dependent on a single crop or particular activity is provided by the experience of Ireland in the 1840s. In that instance the overwhelming dependence of the rural poor on potatoes left them exposed to the impact of a disease known as blight. The resulting famine reduced the population from eight to five million in a few years. A million died and the rest emigrated. The Resilience Alliance argues that to avoid such events we must protect natural and production systems by maintaining their diversity and key ecological processes, ensure that institutions retain their capacity to change in response to altered circumstances and eschew dependency on a limited range of activities that could be subject to disruption.

A similar but less drastic example of threshold change in more recent times is the salinization of Western Australia’s wheat belt. Figures for the extent of land affected vary widely but according to the National Land and Water Resources Audit’s Australian Dryland Salinity Assessment 2000, over four million hectares of prime agricultural land in that state has a high salinity hazard and that figure is likely to double by 2050. A recent study of salinity in the region quoted CSIRO hydrologist Tom Hatton to the effect that:

If 50 to 80 percent of the wheat belt were restored to woodlands, the salinity spread might be stopped – but even with this level of regeneration, it would take several hundred years.

According to the authors this was not a case of disaster striking a society that did not know it was pending. Researchers had warned of the risks in the 1920s and confirmed the dangers by the 1950s. By the 1970s and 80s the problem was visually obvious. Yet the response of the Western Australian state government is still very tentative more than twenty years later.

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There are a number of general lessons relevant to water management in many other parts of Australia. First is the capacity or lack of it, of the political system to take account of relevant research. Second, are implications for the definition of sustainability. Social and economic factors need to be considered along with environmental but the Western Australian example shows that it is not simply a matter of balancing one against the other to get a result that is politically acceptable. If the bio-physical dimension is not taken into account to the extent needed to achieve an acceptable level of sustainability continued environmental decline will eventually overwhelm the short-term benefits to be gained by focussing on social and economic concerns. Third, is the difficulty involved in making decisions to provide long-term benefits to society in general and future generations at the expense of particular groups and individuals in the present. When a system is overcommitted either as a result of over-allocation of water or over-clearing of a groundwater recharge zone, how can further expansion be stopped, when each new project is important to its proponents but only has a marginal negative impact, even though the cumulative total is known to be large?

In addition, there is the role of the federal system. It might appear that there is no case for involvement by the national government in that the problems of the Western Australian wheat belt are contained within one state. However, national agencies such as the CSIRO have played a major role in researching and publicising the dryland salinity issue in Western Australia despite state government disquiet about their findings. One of the arguments in favour of federalism is that the existence of overlapping jurisdictions makes it harder to suppress debate about difficult issues. This has been borne out by the Western Australian example and, arguably, the federal system provides the same benefit in the MDB.

Similar issues are identifiable in the history of the western division of New South Wales, the subject of the much-celebrated Royal Commission into the Condition of the Crown Tenants conducted in 1900/01. That inquiry documented the course of European interaction with the climate and landscape through the previous half century and made a series of recommendations about future management that were regarded as particularly insightful then and since, although they have largely been ignored in practice. The story of the western division can be told at different levels. There is the protracted but moderately successful story of how the practice of wool-based pastoralism has been adapted to fit in with the environment. In parallel, however, the world market for that industry has slowly undermined the viability of wool production as an economic activity upon which to base human occupation of the region20. The story of the western division shows that discussions about how to achieve sustainability cannot be conducted as a simple discourse about the bio-physical relationship between people and the particular environmental resources that they depend on at a given time, in this case the rangelands to produce wool. It is not a matter of focussing on a specific set of interactions and ‘getting it right’ but rather a process that requires continual appraisal.

Another of these cautionary histories is that of the rich agricultural Goulburn-Broken region in northern Victoria\textsuperscript{21}. Over the past 150 years it has been transformed by the clearing of perennial vegetation that has allowed much higher rates of recharge to groundwater. This has changed the hydrological cycle, which rises and falls with succeeding dry and wet climate periods. Under pre-development conditions the depth to the groundwater table was 20 to 25 metres so variations were of no consequence for surface vegetation. The groundwater table now, however, is very near the soil surface. As a result, the buffer zone within which the water table can be allowed to oscillate without reducing productivity has become very narrow.

The problem first came to wide public attention during a series of wet years in the early 1970s when salinisation and water logging caused by rising water tables resulted in annual losses of 30 to 50 percent in many stone fruit crops. At that time it was estimated that over half of the region was at risk from high water tables. The situation has been contained since then by a range of engineering interventions which includes an extensive system of pumps that remove more than 100 million litres of groundwater a year. Although much of this water is reused in the short term over time it is gradually becoming more saline as it picks up salt concentrated near the landscape surface. Concern about the potential impacts on the River Murray prevent saline waste being pumped to streams so this groundwater pumping merely provides a means of managing the problem, not a long-term solution. When the region next experiences a wet climate cycle its economic and social well being could be highly vulnerable. The history of groundwater management in the Goulburn Broken Valley has many lessons for land and water management elsewhere. One of the most notable is that today’s difficulties are the result of a threshold crossed unknowingly decades ago. Many other areas have been severely modified by increased development in the same way as the Goulburn Broken sub-catchment. So far the fraught discussions about environmental rehabilitation programs to deal with the issues that are emerging have usually only involved very small concessions by production-based interest groups. For longer term sustainability and resource security these debates will need to take account of a much wider range of factors than has been the case in the past.

The National Water Initiative is the result of over ten years of policy development going back beyond the Council of Australian Governments 1994 rural water reform program.

The NWI needs to be interpreted in the context of National Competition Policy and the history of the evolution of the Australian federal system.

The NWI should be seen as a work in progress with issues such as the protection of water quality, management of climate change and capacity to link policy for flora and fauna with water, all requiring considerable additional development.

Creating stronger systems of water entitlements before environmental sustainability is achieved will not necessarily result in greater reliability of supply or certainty for investment.

Robust water plans that are capable of restoring environmental sustainability, halting the decline in resource security and managing competing demands are the key to implementation of the NWI.

The NWI requires a system-wide approach to policy and management

The requirement to achieve environmental sustainability at whatever level of modification has been negotiated, gives rigour to the process of balancing social, economic and environmental considerations.

Water markets provide energy which can be harnessed for reform and growth but this requires appropriate institutional settings.

There is a danger that the reform drive to implement the NWI will falter because its key themes are not widely understood.

The NWI proposes that water entitlements will be traded without needing to take account of the contents of the attached regulatory approvals that determine how the water can be used. This could cause serious tensions in that it is the regulatory approvals that determine much of the value of the water entitlements.

The NWI argues that water trading will require a comprehensive framework to ensure that it is environmentally beneficial. Introduction of such a framework could make water trading more complex not less.

Expansion of the ambit of the NWI to include a range of activities occurring in the dryland sections of catchments will require a much more comprehensive institutional framework and a greater degree of community consensus than currently exists.

Implementation of the NWI will need a major expansion in the knowledge and monitoring base underpinning policy.

A thorough review of existing policy and administration will need to be undertaken before implementation of the NWI can proceed.

A strong system of regional catchment management is implicit in the NWI.

The biggest threat to the implementation of the NWI is the looming skills shortage.

In Australia the National Water Initiative (NWI) is the policy framework that has been designed to deal with these issues. It combines recognition of the enormous economic benefits to be gained from water with a stress on the need to make the overall management regime sustainable, thereby protecting the interests of future users, broadly defined, and current users in the future. It also shows awareness that to
protect economic benefits the water management regime must be accepted by the wider community. This means that other claims, environmental, social, cultural, aesthetic and religious, in addition to those with an economic base, must be taken into account if economic activity and water management are to be conducted in a politically stable environment.

The Council of Australian Governments (CoAG) was the forum within which the NWI was negotiated. CoAG is the most recent iteration of a series of institutional processes that have been created to coordinate the two levels of government in the Australian federal system. After more than a century of struggle between the states and national government during which the latter has steadily grown more powerful but the former have continued to find effective ways to frustrate its intentions, CoAG has become the policy sphere within which many areas of joint constitutional responsibility are coordinated. At meetings of CoAG the fiscal dominance of the national Government within the Australian federal system gives it a controlling influence but the constitutional sovereignty of the state governments allows them to opt out of a given policy project should they think fit. In the short term this has provided a way for the national government to exert increasing power but prevented the build up of unmanageable political pressure.

The NWI is a new episode in an old story, not a settled policy. It should be seen as an ideological battlefield, where the terrain has been rearranged, but upon which conflict will continue between old foes convinced that the struggle to control the future of Australian water management is still to be won. Water policy has long been a difficult policy area for Australian governments. During the protracted discussions that preceded agreement on the NWI a senior Commonwealth Government cabinet minister described the experience as similar to wrestling with smoke. Approved in June 2004 the NWI was developed by CoAG working from the principles contained in its 1994 water reform program. It is the most recent product of a long tradition in water policy extending back to the late nineteenth century when the Australian colonies largely abolished riparian rights and established government control over water resources. The NWI puts forward an ambitious plan to restructure water management and promote economic growth within a strong regulatory framework designed to improve and protect the environmental condition of both surface and sub-surface hydrological systems. The NWI is not an oddity in the context of Australian natural resources management policy. Similar efforts are under way in a number of policy spheres ranging from fisheries to forests. Like the NWI they too combine efforts to maximise productivity while conserving the environmental resource. It’s a difficult balance, however, and often encounters political opposition.

To be properly understood the NWI needs to be viewed in the wider context of National Competition Policy, arguably CoAG’s primary concern. It is part of the nation-building enterprise that began well before federation in 1901 and not merely an attempt to solve Australia’s contentious water management problems. The aim is to meld the semi-autonomous states into a more unified national economy and society. In the sphere of water policy the NWI is meant to promote this process by

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strengthening management, encouraging water trading and reducing the significance of state borders. For 150 years agricultural and pastoral development in the southern part of the Murray-Darling Basin, for example, has been dominated by the state capital cities, in effect creating three competing centres of economic activity. From the late nineteenth century to the middle decades of the twentieth, the three states established irrigation-based communities in their hinterlands and provided subsidised water and many other services to promote their growth. At the same time they developed their railway networks to link them to their state capitals and discourage trade across state borders. The placement of these communities and the policies used to promote them made sense to decision makers who were fostering state-based economies but in some cases at least they now make less sense from a national or basin-wide perspective.

It is not just the objectives of policy that have changed. There have also been significant shifts in the approaches taken to implementation. In the field of environmental management, rewards rather than punishments and devices such as the structuring of markets are now the favoured options of governments rather than the command and control approach of earlier times. Australians are not accustomed to the use of strong regulatory regimes in the field of environmental management. According to the legal researcher Gerry Bates:

> The law invariably confers broad discretionary powers on decision makers; it does not confer duties. Although access to a wider range of management tools is essential in devising appropriate responses to natural resources management issues, criteria for measuring the success of decision making against the objectives of legislation are markedly absent in legislative schemes and requirements to monitor the effects of policies, programs and decisions are generally also lacking in legislation\(^24\)

A number of reasons for the weakness of environmental legislation can be suggested but it is difficult to escape the suspicion that governments do not assign to this area the same priority that they do to others that are equally hard to regulate but of higher community concern. There seems to be sufficient electoral support to allow governments to introduce schemes that reward change but sufficient opposition to laws that penalise negative behaviour that they avoid using regulatory power whenever possible. Increasingly favoured is the development of market processes that if well designed provide inducements to more sustainable behaviour and unleash the additional energy that can come from the exercise of self interest.

Twelve months before the NWI was approved by CoAG an influential statement titled *Blueprint for a National Water Plan* was released by a number of senior biophysical and social scientists who became known collectively as the Wentworth Group\(^25\). Established to influence public debate and government policy the Wentworth Group has been coordinated by World Wildlife Fund Australia. Their blue print brought together the main themes of a large body of research and proposals in a form that lent itself to translation into official policy. The group argued that it was essential to improve the environmental sustainability of Australia’s freshwater water systems and


\(^{25}\) Wentworth Group of Concerned Scientists, 2003 July 31\(^{15}\), *Blueprint for a national water plan*. 
in particular the Murray-Darling Basin and put forward a plan to promote economic
development, protect environmental sustainability, and provide clean water for human
consumption. The blueprint proposed a new water entitlements system meant to
encourage water trading and economic growth but be consistent with natural
ecological processes. It also made recommendations designed to support the
communities that would be directly affected. Its publication was followed rapidly by a
draft of what would be the NWI, consultations across the country, frenetic
negotiations between the national government and the states, and eventual release by
the Council of Australian Governments.

A significant element that increased the influence of the Wentworth Group was its
success in imposing coherence on a complex body of policy proposals that had been
debated for a number of years. This included the 1994 CoAG water reform program,
the work of the Agriculture and Resource Management Council of Australia and New
Zealand (ARMCANZ) the Australian and New Zealand Environment and
Conservation Council (ANZECC), the Tripartite Agreement of 1999 and the Prime
Minister’s proposal in 2002 of a research strategy for ‘An Environmentally
Sustainable Australia’ with water as the first of four national priorities. This
background is important in that it indicates that the NWI was the product of a long
history of policy development and not an aberration approved in a hurry without the
relevant decision makers and their advisors having the opportunity to fully understand
its contents, philosophy and approach to implementation.

A key body in the evolution of the NWI has been the National Competition Council.
It is useful to examine its approach to environmental issues in order to better
understand the influences that have shaped national policy about water. In 2004 the
NCC put forward its summary of the key elements of the National Principles for the
Provision of Water for Ecosystems produced by ARMCANZ and ANZECC:

1. River regulation and or consumptive use should be recognized as potentially
   impacting on ecological values.
2. Provision of water for ecosystems should be on the basis of the best scientific
   information available on the water regimes necessary to sustain the ecological
   values of water dependent ecosystems.
3. Environmental water provisions should be legally recognized.
4. In systems where there are existing users, provision of water for ecosystems
   should go as far as possible to meet the water regime necessary to sustain the
   ecological values of aquatic ecosystems whilst recognising the existing rights
   of other water users.
5. Where environmental water requirements cannot be met due to existing uses,
   action (including reallocation) should be taken to meet environmental needs.
6. Further allocation of water for any use should only be on the basis that natural
   ecological processes and biodiversity are sustained (that is ecological values
   are sustained).
7. Accountabilities in all aspects of management of environmental water should
   be transparent and clearly defined.
8. Environmental water provisions should be responsive to monitoring and
   improvements in understanding of environmental water requirements.
9. All water uses should be managed in a manner which recognizes ecological
   values.
10. Appropriate demand management and water pricing strategies should be used to assist in sustaining ecological values of water resources.

11. Strategic and applied research to improve understanding of environmental water requirements is essential.

12. All relevant environmental, social and economic stakeholders will be involved in water allocation planning and decisions-making on environmental water provisions\textsuperscript{26}.

Notable in this summary is the requirement that the environmental needs of hydrological systems should be supplied first. Allocations should be based on the best available scientific information regarding what is needed to sustain ecological values. If necessary, extra water should be reallocated away from diverters to the environment to protect ecological values. In addition, there should be the widest possible involvement of affected communities and stakeholders taking comprehensive account of their environmental, social and economic interests.

The National Water Initiative is attempting to create rights within a public policy framework. This is occurring in a water management context where the relationship between governments, public water authorities and private water users, principally irrigators, is changing significantly after more than a century of relative stability. For many decades the interests of governments and water users were very similar. Governments used water as a tool to promote the growth of communities and there was little concern about environmental issues. During this period even though water entitlements were usually vaguely defined from a legal perspective the reliability of supply was relatively high in light of the biophysical circumstances. Variations were usually the result of administrative decisions made in response to drought and concerns about future supply and the decisions were accepted as sensible and necessary in the communities affected. In more recent times this congruence of interests has broken down. The growth in diversions in the second half of the twentieth century has caused serious environmental problems and intensified competition between water users. Increasing insecurity about the reliability of supply has resulted in calls for greater legal security of entitlements at a time when governments have decreasing capacity to satisfy such demands.

Tension between promoting economic activity by giving greater certainty, and the need to retain or improve management flexibility to protect the environment, can be resolved if the rights created apply to a sufficiently modest proportion of the resource that enough is left unclaimed to allow public policy goals to be pursued. In principle the NWI attempts to resolve this conflict by requiring that all systems be, or be restored to, environmental sustainability before perpetual rights are allocated. The risk is that the process of establishing an environmentally sustainable regime will not be sufficiently rigorous to regain the volumes of water and flexibility needed to achieve that condition. Given the political strength of demands for greater legal recognition of a wide range of different types of water entitlements, and the unanswered questions that persist about who can represent and protect the environment, there is a real danger that water property rights will be locked in at too high a proportion of total

\textsuperscript{26} National Competition Council, June 2001, \textit{Assessment of government progress in implementing the National Competition Policy and related reforms: Murray-Darling Basin Commission water reform}, p. 32.
flow. If that happens riverine environments will continue to decline and resource security will be further eroded.

An indication of the difficulties that face policymakers attempting to balance the competing demands for greater certainty of water entitlements, against what is required to manage for environmental sustainability, is provided by the NWI’s treatment of the issue of climate variability. A key concern for governments and people involved with water plans and the perpetual water access entitlements that they will make possible, is responsibility for future risk, largely from the impact of drought and climate variability. In the NWI, paragraphs 46 to 49 provide principles for dealing with climate variability but they do not appear to have resolved the fundamental tensions. Paragraph 49 attempts to balance the requirement for environmental sustainability and the diverters understandable desire for legally protected certainty by providing for a two-stage process. In the initial phase the level of water required in-stream to protect environmental sustainability is to be determined without compensation to entitlement holders: after the implementation phase variations will be compensated for if they are the result of additional policy changes or reductions of more than three percent over ten years. (In paragraph 51 the governments agree that if they so wish the states can vary the cost sharing formula applying to reductions in allocations needed to achieve sustainability. This presumably means that they would provide some compensation for the transition.)

Although this arrangement might seem favourable to the environment it appears to require the abandonment of the capacity to subsequently adjust the size of the consumptive pool from year to year as a result of climate variability. To be able to decide if and when the three percent threshold is crossed, thus triggering the requirement for compensation, a stable volumetric definition of the size of the consumptive pool will be needed. Without a definable base line it will not be possible to calculate the three percent. A stable volumetric definition is also implied by the lack of discussion of the possibility that the size of the consumptive pool will vary from year to year in the sections of the NWI that deal with water plans and perpetual entitlements.

The tensions within paragraph 49 are not present in other parts of the NWI. Paragraph 48 pulls in the opposite direction. It requires diverters to bear the risk (ie without compensation) of climate change and periodic natural events such as bushfires and drought, presumably by receiving a smaller volume of diversions. That implies variation in the size of the consumptive pool in response to changing circumstances. But how will it be made compatible with the need to define the consumptive pool in a way that can be used to calculate a three percent variation in allocations? These are just one of the conflicts that can develop when a stronger property rights approach is grafted onto a water management system based on administrative public policy principles.

An example that shows how a water distribution system based on strong legal entitlements can develop, is provided by the management of the Colorado River catchment, which extends across seven states in the south west of the United States and northern Mexico. The Colorado catchment is divided into what are known as the

27 NWI, 49, i.
upper and lower basins by the Grand Canyon, which has been cut through the landscape by the Colorado River. The lower basin includes southern California, Arizona and Nevada (Las Vegas). They use their share of the water for hydro power, irrigation and human consumption. It is now a number of years since any water has been allowed to run out to sea and consumer demand is intensifying.

The story of water sharing between these states and the people in them is one of the great sagas of the American west. The phrase ‘law of the river’ is the collective term used to describe the body of treaties, legislation and court decisions that provide the legal context for inter-jurisdictional water management in the Colorado basin. One of the earliest and most important components of the law of the river is the Colorado River Compact negotiated in 1922. The stimulus was a Supreme Court decision which found that the legal principle of prior appropriation ‘first in time first in right’ applied across state borders. This meant that water diverted for rapid economic and agricultural development in California would establish an indisputable claim to water from throughout the Basin for all time thereby effectively reducing the potential for development in the other states. Intense political activity led to an all-states conference (which excluded Mexico) and resulted in an agreement that divided the Colorado water equally between the upper and lower basins with an extra one million acre feet (approximately 1250 GL) assigned to the lower basin states to encourage them to accept the deal.

The compact of 1922 was later included in an act of the United States Congress passed in 1928. This restricted California ‘irrevocably and unconditionally’ to an entitlement of 4.4 million acre feet (MAF) as a pre-condition to the Federal government funding and building the huge Hoover Dam. Subsequently California ignored this constraint and took more water than its allocation for many years until the earlier decision was reaffirmed by a Supreme Court decision in 1963 after a long legal battle with Arizona. The 1928 Act also gave responsibility for overall coordination and implementation of the water sharing arrangements for the lower basin to the Federal Secretary of the Interior. Other significant elements of the law of the river include the water sharing treaty with Mexico in 1944 and the Environmental Protection Act of 1973. Perhaps surprisingly the law of the river has little to say about water quality problems such as salinity, which in the case of Mexico has wiped out much of the benefit that might come from its allocation.

Supposedly the compact of 1922 gave the upper and lower basins each 7.5 million MAF a year. The upper basin, the source of much of the water, was committed to supply 7.5 MAF a year, more precisely 75 MAC every ten years, plus the additional million to be divided between the three bottom-end states. In addition, since 1944 the two basins have also had to provide 1.5 MAF to Mexico taken equally from both allocations. This division of the waters of the Colorado Basin was based on an estimated average stream flow of 16.4 MAF based on data collected during what turned out to be a sequence of wet years. More recent analysis, however, has revealed that the average flow over 3 centuries is about 13.5 MAF, and has been as low as 4.4 MAF and as high as 22 MAF in extreme years. The longer record also shows that there can be long sequences of low flow years. The region is now experiencing one of the worst droughts in the last 500 years and climate change threatens. Although increased flows are predicted they are expected to be in more random and extreme
sequences. Given the rigidity of the water sharing formula applying in the lower basin its management arrangements are now under severe pressure.

The reassessment of the average level of flow from 16.4 MAF to 13.5 MAF did not result in reductions to allocations all round. The upper basin states were still held to the requirement to supply 75 MAF to the lower basin over ten years and had to absorb the full impact of the reassessment. To cope with this they divide their share of the water by allocating percentages to each state and coordinate management through a permanent joint body, something the more disputatious lower basin states have never seriously contemplated. The hierarchy of water rights that will be applied if the drought continues gives an interesting indication of the way a rights based water management regime deals with variability. The most senior rights, perhaps surprisingly given the way they have been treated historically, are the allocation to Mexico and the Indian reservations. Within California the irrigators of Imperial Valley, the holders of entitlements to about three quarters of the 4.4 MAF allocated to that state from the Colorado, has a more senior right than do cities such as Los Angeles. In turn the irrigators and people of Arizona have a more junior right than do the irrigators and people of California. In principle at least this means that a rancher with a senior allocation used to water a few stock could receive a full allocation while a nearby city that has developed more recently will go begging. Water trading has not developed in the region to any significant extent so the market is not available as a device to redistribute water allocations and ease the pressure. In addition, unlike Australia where as paragraph 2 of the NWI states ‘water is vested in governments’, the rights of American governments to intervene in water management in the public interest are not clearly defined or well accepted by society.

Changing to a different system of allocation to respond to drought or climate change is likely to generate a major political crisis because it would probably involve significant impingement on strongly held cultural values applying to ‘property’. By contrast in the Murray-Darling Basin, during times of drought the three southern states are allocated a proportion of what is available and irrigators and other diverters have entitlements of different levels of security that closely reflect public policy priorities at the time when the decisions were made. Under these circumstances a drought causes serious social and economic distress but the need to supply urban centres first for example does cause a political or institutional crisis. The Australian system reflects the social expectation that governments will distribute water where the need is as defined by their assessment of the public interest. It also tends to share the impact of shortages between entitlement holders rather than privileging one as opposed to another, thereby reflecting the cultural importance assigned to equity of sacrifice.

Water law varies greatly across the United States with concern for ‘rights’, being most pronounced in the south-west. In the opinion of Kai Lee, a researcher who has written extensively about North American water catchment management, its effects on water management are perverse:

Western water law in the United States is a deeply rooted social institution that fosters misunderstandings, forces those who deal with the problems to act in dysfunctional ways and skews the lessons taught by experience away from understanding…The water right legitimates the benefits belonging to the
holder of the right. It does not acknowledge other claims even though flowing water is virtually be definition a multiple use multiple user resource\textsuperscript{28}.

In Australia under the National Water Initiative, water rights are to be granted within a framework that protects environmental sustainability and resource security. To be successful this combination will need to be based on a robust definition of sustainability.

**The need to give priority to sustainability**

According to the NWI the tensions between the many different demands that are placed on hydrological systems are to managed through the development of comprehensive water plans. It is through their preparation that the difficult issues involved in balancing the need for sustainability and the ambitions of production interests are to be resolved. 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, capacity to address emerging issues and many more elements\textsuperscript{29}. They are to provide for ‘adaptive management of surface and groundwater systems\textsuperscript{30}, with their connectivity recognized where it is significant\textsuperscript{31}. In addition, water plans must take account of Indigenous issues by making arrangements for Indigenous representation in water planning ‘wherever possible’ and provision for indigenous social, spiritual and customary objectives ‘wherever they can be developed’. They should also include allowance for ‘the possible existence of native title rights to water in the catchment or aquifer area\textsuperscript{32}’.

Water plans are to reconcile some of the most intractable issues facing water policy makers and managers. In each case they are to recognize the particular and sometimes unique characteristics of the water system for which they are designed. They are also to provide a common currency that will allow entitlements to be traded from one region to another. A perpetual entitlement as created by the relevant water plan will give its owner a proportion of the flow defined as available for extraction\textsuperscript{33}. Accompanying each perpetual entitlement will be a second document variously designated in the NWI as a regulatory approval, a water use license or a works license. It is this document that defines the impact of the water plan on the perpetual water access entitlement and creates the product that can be used or traded. The regulatory approval will need to take account of relevant legislation appertaining to that region, be consistent with the local water plan, make adjustments for a wide range of potential impacts on third parties including those downstream, explain the conditions under which it could be withdrawn and set out avenues for appeals.

\textsuperscript{28} Kai Lee Compass and Gyroscope, p153
\textsuperscript{29} NWI, 23, 25, Schedule E.
\textsuperscript{30} NWI, 25.
\textsuperscript{31} NWI, 23, x.
\textsuperscript{32} NWI, 52-54.
\textsuperscript{33} NWI, 28.
According to the NWI, the organisation responsible for issuing the regulatory approvals will need to be independent and have the necessary authority to monitor and enforce the conditions imposed on the approval. Paragraph 32 also stresses that the entitlement holder will have responsibilities and obligations and that the minister and the relevant state agency will have the discretion to cancel it ‘where the responsibilities and obligations of the entitlement holder have clearly been breached’ subject to appeal.

The NWI states explicitly and repeatedly that the volume of flow needed to maintain environmental sustainability, at what ever level of modification has been defined as reasonable in the negotiations involved in the development of the relevant water plan, must be met first before allocations for extraction are determined. Much of the NWI focuses on the promotion of economic activity but there are many sections that state the principle that all water bodies, no matter what level of modification is accepted as appropriate, must be maintained in or restored to an environmentally sustainable condition as the first priority. This is not a drafting error in that it is a logical result of the definition of the task. It is hard to see how a national policy for the long term could advocate anything less than the protection of the basic resource upon which all else depends. However, this is a radical proposition in the context of Australian water management.

Such a requirement puts the NWI fundamentally at odds with many major water management policies and programs in the MDB, notably the Cap on extractions (as will be explained later). One of the odd features of the on-going debate about the future of Australian water management is that almost no one puts forward an explicit in-principle defence of unsustainable management but so many take that approach in practice. When it is presented, the case for unsustainable practices is usually a defence of social and economic benefits threatened by efforts to achieve reform. Rarely is there any effort to confront the possibility that the capacity to maintain them will be eroded by continued business-as-usual. It seems that many people involved in water management do not accept the proposition that environmental sustainability is a necessary long-term foundation for economic activities. The release of the NWI highlights this disjunction and sets the scene for a widespread struggle about the fundamental assumptions underpinning water management in Australia.

Central to the NWI is the development of processes to define the requirements of environmental sustainability and institutions able to ensure that they are achieved and maintained. This gives the debate about the meaning of the concept ‘environmental sustainability’ a new urgency. Extrapolating from the Brundtland definition of sustainability and the relevant sections of the NWI there would seem to be two minimal criteria that need to be met for a modified environmental system to be defined as environmentally sustainable: its environmental condition needs to be stable from a system-wide perspective and politically acceptable to society in general.

The requirement that the level of environmental sustainability should be stable, durable and maintainable over a reasonable period of time and not in a state of continuing decline has many implications. The NWI appears to make no provision for a situation where a specific site is defined as sustainable (perhaps as a result of a

34 NWI, 23,25, 41-49.
locally focussed management regime) while the wider system of which it is a part is in a state of continuing decline\(^{35}\). This is made clear in many sections of the NWI. It requires ‘the return of all currently over allocated or overused systems to environmentally sustainable levels of extraction’ and ‘recognition of the connectivity between surface and groundwater resources and connected systems managed as a single resource’\(^{36}\). Similarly, the planning framework is to ‘implement firm pathways and open processes for returning previously over allocated and/or overdrawn surface and groundwater systems to environmentally sustainable levels of extraction’\(^{37}\).

Efforts to achieve stability system-wide will depend on a strong capacity for scientific research and monitoring. Implementation will require detailed knowledge of the ecosystems in question so that the prerequisites for stability can be included in the relevant management programs. The historical record has shown that Australian ecosystems are highly variable, poorly understood and subject to unpredictable threshold changes so increased investment in science to gain a better understanding of ecosystem dynamics is essential. Crucially, when management plans are being negotiated, substantial scientific input will be needed to make sure that economic and social considerations do not result in compromises that will undermine environmental stability in the longer term. Given the considerable time lags that often exist between actions and their environmental consequences, it is easy for the rhetoric of the moment to disguise such a risk.

The environmental management regime agreed on through the water planning process needs to be politically viable for a reasonable period of time. This assumes institutional arrangements that will encourage productive negotiations and help ensure that the resulting decisions are implemented in practice. An essential foundation is cultural values that are likely to attract long-term community support. Water plans should not be based on fragile ad hoc deals opportunistically made between key interests. Horse trading as it has often been conducted in the past is not likely to provide the security desired by production-based groups because political conflicts will continue to grow if the causes are not resolved.

It is essential that the negotiations required to produce the water plans not be dominated by economic considerations alone although they must be taken into account. Long-term costs and benefits defined in financial terms are usually so severely discounted that they are often only a minor influence on decision-making\(^{38}\). Even at very conservative rates of return, cost and benefits that will be realised two or three generations in the future are rendered insignificant in comparison with short-term costs and benefits. This creates pressure to minimise consideration of the long term but that is not appropriate for water policy. Except under exceptional circumstances such as large floods or severe droughts, biophysical conditions at any given time are usually the result of activities undertaken many years earlier.

\(^{35}\) Council of Australian Governments, 2004 June, *Intergovernmental Agreement on a National Water Initiative*. (The notation used throughout the thesis is NWI, number of paragraph, number of letter of subsection ie NWI, 63, ii (b).

\(^{36}\) NWI, 23, iv and x.

\(^{37}\) NWI, 25, v.

\(^{38}\) Lee 1993 pp191-193, Common 1995
The debate about the role of markets is central. They provide a desperately needed source of raw energy that can be used to achieve positive change. Used appropriately markets will promote both economic growth and more sustainable practices. However, all markets exist within a cultural and compliance framework. The question is how should they be designed or fostered? There are also the perennial battles about which costs should be included in the ‘water price’. There is strong pressure to under-account for costs such as those created by the maintenance and replacement of the storages and distribution system, servicing the regulatory framework, environmental degradation, forced social change, impacts on future generations and this generation in the future. Costs that are difficult to calculate are often left out. Problems tend to be defined to fit solutions that are culturally acceptable. The very real costs created by ignoring issues that cannot be easily expressed or described are ignored for as long as possible.

An economic perspective also has limited capacity to respond to many moral and ethical issues even though substantial political threats can come from groups driven by such considerations. Those involved often lack market power but that does not mean that they lack political power. Examples in Australia include the Green and Indigenous land and water rights movements. Consequently, medium term security and predictability for management programs and water-based economic activities cannot be provided without a policy and management framework that is able to integrate many different interests, not just those that can exert market pressure, in ways that are acceptable to the wider community.
Sustainability – a policy sphere subject to contested values

Ambivalence between the arguments in favour of working for sustainability and the benefits of a short-term focus on production is a significant factor shaping the politics of water. The tension is not just between people, organisations and governments but also within them. A typical example involving the Commonwealth Government is that of deregulation of the dairy industry in the late 1990s early 2000s. The re-structuring resulted in the closing of a large number of rain-fed dairies along the east coast and a substantial expansion of the industry in northern Victoria and southern New South Wales along the River Murray where the main source of water is diversions for irrigation. This happened without any environmental assessment as to whether it was appropriate to increase the demand for irrigation water in a catchment that was already over-allocated.

During the same period other sections of the Commonwealth government were developing the policies that ultimately resulted in the National Water Initiative with its requirement that all public activities involving water be scrutinised for compliance with its principles. Governments are frequently discussed as if they are actors or agents, a view that encourages expectations of consistency in intent and activities. While that is an understandable perspective in many situations there are times where it is more useful to think of governments as policy spheres within which many different interest groups, with a wide range of cultural values, vie for dominance. Over the next few years these groups will be involved in a battle for the moral high ground that will allow the victors to shape public thinking about what is right and reasonable in the context of Australian water policy.

One of the odd features of the debate about the future of Australian water management is that almost no one puts forward an explicit in-principle defence of unsustainable management but so many take that approach in practice. When it is presented the case for unsustainable management is usually just a list of social and economic benefits that are threatened by efforts to achieve sustainability with no acknowledgement that capacity to maintain them will be eroded by continued degradation. It seems that in practice there is widespread rejection of the proposition that environmental sustainability is a necessary foundation for economic activities in the long term. The release of the NWI highlights this disjunction and sets the scene for a divisive struggle about the fundamental assumptions underpinning water management in Australia.

The logic of long-term policy development creates strong pressure to conclude that at some point the process of degradation and depletion of the resource upon which so much is based should be halted. The requirement to achieve environmental sustainability first is central to the NWI but much of the public discussion of this issue assumes that the primary question should be how much water currently used for production can be spared for in order to achieve environmental sustainability? The controversy over the relatively small reductions proposed for the Living Murray project, which will be discussed in this chapter, indicates that the usual answer is ‘not much’.

According to the NWI, environmental sustainability in modified hydrological systems must be achieved first before provision can be made for extractive demands. Many sections of the NWI make it clear that environmental sustainability is the primary goal and not merely a desirable extra to be taken into account if and when production systems can afford the cost. Paragraph 23, in listing the aims of water plans states that they are to ‘complete the return of all currently over-allocated or overused systems to environmentally sustainable levels of extraction’. Paragraph 48 states that diverters should carry the risk of reduced supply caused by drought, regrowth after bushfire or climate change. Paragraph 49 explains that until 2014, diverters are to bear the costs of ‘any reduction or less reliable allocation’ that may result from the use of the best available science to determine an environmentally sustainable level of extractions. Only after that date will they be compensated for any further reduction of more than 3 percent in a given ten year period. The same order of priorities is present in a number of other sections. This does not mean a return to pre-development conditions but it does require that water systems should be in a condition that can be defined as environmentally sustainable, not in a state of continuing decline as is arguably the case in many Australian hydrological systems.

Under the NWI all modified hydrological systems are to be managed so that their condition is environmentally sustainable from a system-wide perspective. Water plans designed to achieve or maintain environmental sustainability in a systems context are required by the end of 2007 for systems judged to be over-allocated and by the end of 2009 for systems that are not yet over-allocated. The imperative that water bodies be managed system-wide is clear in many sections of the NWI. It requires ‘the return of all currently over-allocated or overused systems to environmentally sustainable levels of extraction’ and ‘recognition of the connectivity between surface and groundwater resources and connected systems managed as a single resource’. Similarly, the planning framework is to ‘implement firm pathways and open processes for returning previously over allocated and/or overdrawn surface and groundwater systems to environmentally sustainable levels of extraction’. This is to be done by implementing the water plans that are the core of the NWI. It is through the process of negotiating these plans that the necessary compromises between social, economic and environmental concerns are to be hammered out. In addition to reconciling local interests this will also require that the compromises are acceptable to the wider society. Rigour will be given to this process by incorporating the various water plans into the state implementation plans, which are to be accredited by the National Water Commission.

Property rights versus security

For some groups involved in the debate about the future of water resources the key issue is not the need to achieve environmental sustainability but rather a stronger legal right for water entitlements. These groups do not accept that failure to ensure environmental sustainability will undermine security of supply which in practice is the underlying demand for most people wanting clear water property entitlements. An

40 NWI Sched. A
41 NWI 23 iv&x
42 NWI 25 v. See also NWI 41-45 and Scheds A & E
example of the muddled thinking that results from this confusion is provided by a major working paper prepared by the Bureau of Transport and Regional Economics (BTRE), titled ‘Investment Trends in the Lower Murray-Darling Basin’\textsuperscript{43}. This document is symptomatic of the approach to water management taken by groups advocating a strong focus on so-called free market processes in environmental management\textsuperscript{44}.

The authors of the paper describe dramatic differences in investment in irrigation regions between the three states. They reported that South Australia and Victoria have much higher levels of investment than New South Wales. These high levels of investment have major flow on effects throughout the surrounding regional economies. The cause, according to the BTRE paper, is the existence of greater legal certainty of water property rights in Victoria in South Australia.

The region where comparisons between the states can be made most directly is the Central Murray:

> Population, economic activity and investment are heavily skewed to the Victorian side of the Central Murray. There is over four times the number of people, holding four times as many jobs and earning over four times the gross taxable income of the New South Wales Central Murray. The value of Victorian Central Murray’s agriculture is far larger than in New South Wales ($1522 million compared to $649 million) and the growth rates are higher (37 percent compared to 28 percent). This is despite the Victorian Central Murray being physically smaller and using 10 per cent less water than its NSW counterpart\textsuperscript{45}.

Why are there such great differences between the two districts which are separated by only a few hundred metres of river? The working paper argued that it was the result of differences in the security of legal title. An alternative explanation is that over-allocation in New South Wales reduced reliability of supply. The hint that over allocation might be the cause is contained in the last sentence. For the authors of the working paper the fact that investment was less, despite the use of more water, was a strong indication that lower levels of legal certainty must be having an influence. A contrary view is that the greater use of water on the New South Wales side of the river could itself be the main cause of the difference in investment. It indicates the possibility that a higher proportion of New South Wales’s share of the available flow has been allocated for extraction than in Victoria thereby increasing unreliability of supply.

In highly variable river systems such as the Murray, beyond a fairly low point, higher rates of allocation and extraction usually mean a greater frequency of seasons when


\textsuperscript{44} The ‘free market’ requires a strong regulatory framework to create property rights and enforce contracts. The use of the word ‘free’ is a blatantly ideological attempt to attach a concept that has high approval within western cultures to a particular set of economic rules.

\textsuperscript{45} Bureau of Transport and Regional Economics, 2003, \textit{Investment Trends in the Lower Murray-Darling Basin}, p. xxiii. This is a rather strange statement. It is hard to know what to make of the triple repetition of ‘over four times’ which seems an extraordinary coincidence. The growth rates reported also seem very high.
irrigators are not able to receive the full amount of their entitlement. Under such circumstances it makes sense to invest less than in other regions where a lower rate of allocation makes it more likely that the water which is available in principle will also be physically available when its needed. To provide stronger legal security in regions where the water is often not available because of over-allocation merely places governments under some obligation to provide compensation in years when there is not enough rain. This is simply be drought relief by another name.

As already noted New South Wales has been allocating a higher percentage of the available flow than its neighbours. The Cap definition ‘1993/4 levels of development’ included the management rules in place at that time. In South Australia and Victoria these management rules appear to have resulted in a significantly lower rate of extraction than has occurred in New South Wales. According to the MDBC, New South Wales diverts approximately 52 percent of annual runoff compared with 41 percent for Victoria. South Australia has little runoff within its borders but uses approximately 40 percent of its high security entitlement of 1850 GLs and approximately 15 percent of the median annual flow across the border. The long standing New South Wales policy of maintaining smaller reserves in Hume and Dartmouth than Victoria also indicates that it allocates a higher percentage of available flow. All in all, it seems probable that New South Wales is much more exposed to the threat of reduced supply as a result of rainfall variability than the other two southern states.

The failure to take account of the interaction between high rates of allocation and climate variation is only one of many features of the BTRE working paper that attracts scepticism. In discussing the impact of the Cap in New South Wales very little is made of the way in which it was introduced. The Cap was introduced at existing levels of extraction and caused reductions for individuals in New South Wales mainly because its Government decided to divide the same amount of water between a greater number of diverters (whose numbers had swelled as a result of the sale of unused entitlements). If it had only recognized those entitlements that had already been activated, as advised, rather than all entitlements that had been granted (at no significant cost to the recipient) its established irrigators would not have been affected so drastically. This is one example at least where concern to recognize ‘property rights’ has had a destabilizing effect on the economics of an industry.

For some reason the BTRE report ignores the most fundamental cause of uncertainty for water entitlement holders, which is the growing concern amongst members of the

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47 Calculated using information from Murray-Darling Basin Ministerial Council, June 1995, An Audit of Water Use, p. 25, table 6 and p. 8, table 2. It should be noted that in most years South Australia receives considerably more flow than it is guaranteed under non-drought conditions (During drought or times of ‘special accounting’ a different formula is used.)
48 See the discussion regarding the introduction of continuous accounting in chapter six in this thesis.
49 These figures could suggest the availability of large volumes of water that are currently not utilized. For a variety of reasons it is not possible to capture all or most of the runoff for distribution. Presumably losses to seepage and evaporation account for the difference between these figures and flows out of the Murray Mouth which are now only 21 per cent of pre development flows. See Murray-Darling Basin Ministerial Council, June 1995, An Audit of Water Use, p. 16.
50 Interview Don Blackmore 2003.
Australian electorate about environmental decline. Irrigators will unavoidably experience continuing uncertainty until rivers are restored to a condition that most voters find acceptable. In addition, it will become increasingly difficult for governments to make concession to irrigators in the absence of that restoration. There is likely to be increasing demand for a more comprehensive definition of costs to take into account more of the cost of infrastructure and of rehabilitation of the damage done by high rates of extraction, and that this reassessment be included in water prices. The prospect of an alienated voting public is a long term threat to the irrigation community. It could undermine marketing campaigns in an increasingly liberalized world economy if producers want to appeal to consumers on grounds such as sustainable production methods or patriotism. It could also result in increasing scientific rigor being applied to the definition of environmental sustainability. Under the NWI, diverters will get a perpetual share to a consumptive pool whose size will be defined by what is left after the environmental needs of the system have been calculated. The process of agreeing between now and 2014, on the level of modification that is acceptable and the volumes of water and management systems needed to achieve or maintain that condition in each hydrological system, will not take place in a political vacuum. Delay, in a situation of continuing environmental decline, could prove very costly in that the eventual decisions will be made in a more hostile political environment. Diverters have a strong interest in returning Australian water systems to an environmental condition that is politically acceptable to the general public as soon as possible.

The National Water Initiative – areas needing further development

Implementation of the NWI is happening very fitfully not least because many of the people who discuss it publicly do not appear to have read it. A typical example was a feature article that appeared in the Sydney Morning Herald in July 2006 which claimed that ‘under the National Water Initiative of 2004 Australia’s governments agreed that if water had to taken from farmers for the environment it would be paid for’. The author was apparently unaware that paragraph 49 of the NWI requires that up until 2014 entitlement holders in over-allocated systems would have to bear the full cost without compensation of reductions to achieve sustainability. After that date entitlement holders are to be compensated for reductions of more than 3 percent over a ten year period. In addition, paragraph 48 requires that entitlement holders should bear the full cost without compensation of reductions to deal with climate change and drought.

Many people appear to base their understanding of the NWI in relation to this issue on paragraph 79(ii) which lists ways in which governments can recover water for goals developed though the public policy process that are additional to what is required to first achieve an environmentally sustainable level of allocations. (Popular confusion about this issue could not survive a single quick read of the NWI itself. Although a rather dense document it is quite short.) Despite the rational austerity of paragraphs 48 and 49 there is a strong argument that governments should give compensation for any reduction in allocations to achieve sustainability. This could be justified on the

51 NWI, 28, 41-49.
52 Daniel Lewis 8/7/06 ‘Fat ducks, fat cattle, fat chance’ SMH p31.
grounds of equity (irrigators should not have to bear the full burden of a shift in cultural values) and by the need to settle disputes quickly so that progress can be made in restoring sustainability where it is being compromised. Taking account of such considerations CoAG did agree in paragraph 51 that state governments could work out a different risk sharing formula for achieving sustainability if they wish. The most obvious way in which that could be done is by providing some sort of financial compensation. What was not in doubt, and this is significant given public discussion about whether governments should risk causing ‘distortions’ to water market prices by buying water for the environment, is that governments made a commitment to move decisively according to a demanding time table to reshape water management across the country so that for the first time environmental sustainability and resource security would be protected.

The widespread ignorance about the contents of the NWI would not be particularly significant but for its wider implications. Given the political difficulties that will be involved in implementing the NWI, there is a real danger that the commitment to achieve sustainability and protect resource security will become a dead letter, too hard to define or enforce and politically more trouble than it is worth in the short term. A factor that increases this danger is the apparently optimistic assumption contained in the NWI that it will be relatively easy to get governments and the public to accept its provisions. At this stage the main inducement for compliance is the prospect of payments for projects by the Commonwealth through the National Water Commission. This will work in situations where lack of funds is the main obstacle but it is not likely to be effective for those issues where governments face the prospect of real political pain. Returning water to the environment is just one example of such an issue and probably not the most difficult. Successful implementation of the NWI will not happen without strong public support based on a sophisticated understanding of what it is designed to do. At this stage that understanding is lacking and there has been only minimal investment in activities that will create the change in cultural values that is needed.

Although not an easy document to digest the NWI is a serious response to many of the issues that will dominate water management in coming years. It is not simply a matter of studying the NWI, however, to find out what has been agreed by governments. The NWI contains a number of unresolved tensions and is really only a starting point. The ambiguities involved in paragraphs 48 and 49, for example, have already been discussed and there are many other areas of the NWI that will also need substantial development before they can be incorporated into management practice. One of the most important of these unresolved issues is the plan to make water trading easier by separating water entitlements from the regulatory approvals that define when and under what circumstances the entitlements can be used.

Separation of water entitlements from regulatory approvals is meant to make it easier to increase trade in water entitlements from one hydrological system to another. The water entitlement will create a ‘right’ to a proportion of the relevant consumptive pool and the regulatory approval will define the conditions under which it can be exercised. This new approach appears to assume that the variation in the contents of the regulatory approvals in different regions will not be so great as to produce significant differences in the value of water entitlements. In some cases this is correct but in others it will not be.
The regulatory approvals are meant to take account of the characteristics of the different hydrological systems and they will determine the real value of a given water entitlement for anyone who actually wants to use it. As water markets mature it is likely that the differences in economic utility between the regulatory approvals developed for the various regions will be reflected in the price of the water entitlements to which they are attached. A water entitlement that can be used in a wide variety of circumstances will probably be regarded as more valuable than one that can only be used in a limited range of circumstances. But if so this will put water traders back where they started from before water entitlements were split from their regulatory approvals. Once again they will be faced by a multitude of unlike products the comparative value of which it will be difficult to determine.

A strong theme of the debate about the desirability or otherwise of less restrictive water trading rules is that there was considerable waste resulting in lost economic opportunities and environmental damage under the previous long established water allocation systems. In some instances this was no doubt true but to what degree is uncertain, particularly in light of recent research that indicates that in many regions a significant proportion of diverted water eventually returns to rivers and streams and once again becomes part of in-stream flow. Promoting the development of water markets and making water a valuable trading commodity has almost certainly increased the overall volume diverted for production. Assessed from the perspective of improving environmental sustainability, to what degree do the benefits more than balance the negative consequences?

Central to that question is the quality of the regulatory framework that will be developed as a result of the NWI. Taken at face value, the NWI will put in place a number of constraints that could provide formidable obstacles to active trade across wide regions. The guidelines for trading operations are set out in Schedule G of the NWI. A trade may be refused because it is inconsistent with the relevant water plan. Trades are not permitted to result in the sustainable yields of the region where it will be used, being exceeded. Further, they should not ‘increase seasonal reversals of flow regimes above sustainable levels identified in relevant water plans such that environmental water or water dependent systems are adversely affected’. Interestingly, ‘trade from a licensed runoff harvesting dam (ie not a small farm dam)’ can take place, but among other requirements, this will be subject to an equivalent reduction in dam capacity, a difficult condition to enforce. In addition, under the system outlined in the NWI there will also be more opportunities for litigation by aggrieved third parties who will have enhanced standing under the new principles.

If implemented as written the NWI will probably make water trading more complex not less. So far in the MDB many of the problems that the NWI attempts to solve for wider regions have been avoided by restricting trade to high security entitlements in a defined area in the middle and lower reaches of the River Murray that has similar supply characteristics across its full extent. In effect, this allows purchasers to know with confidence how much water they will get for their money when making a

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54 NWI, 11 Schedule G.
purchase. It is difficult to see how that confidence will be created under the new system.

The NWI aims to promote trade in water entitlements of more varied levels of security of supply across much larger geographical areas than is now the case. A number of sections of the NWI deal with these issues, but they do not explain how transactions will actually be done. This may seem a low level concern that should not be detailed in an intergovernmental agreement, but it goes to the heart of the question, to what extent will these proposals incur such high transaction costs that they will negate the benefits of water trading? How will a proportion of X that can only be supplied in full in a defined frequency of years (ie when water is available due to adequate flow) as established by the water plan for one water system, for example, be translated into a proportion of Y as determined by the water plan that applies to the delivery site of the purchaser, when the two water systems have different hydrological characteristics? Will the percentage of years that the full entitlement is supplied be derived from the river conditions in the place of origin or in the place where it is being used? If it is supplied in a higher frequency of years in the place of use compared with the place of origin will this not increase the total volume of water taken from the catchment in question?

Over time a single irrigator could purchase water from a number of different places each with its own supply characteristics. Her or his neighbour could do the same, quite possibly sourced from a different set of regions with different characteristics again. Eventually an extraordinary mosaic of water entitlements would evolve despite the supposed existence of a single national system created by the NWI. Alternatively, a process may be developed that converts each of these incoming entitlements into a product with characteristics defined by the regulatory approval of the local water plan. These questions are not meant to suggest that this problem cannot be solved, only that the solutions will vary from place-to-place and year-to-year depending on seasonal conditions (the source area could be having a wet year while the place of purchase is in drought or vice versa). Very high quality record keeping will be required and it is hard to see how continual negotiations could be avoided. Water trading and subsequent management conducted under these conditions are likely to result in very high transaction costs indeed.

The regulatory framework set out in the NWI has been included to make sure that water trading will enhance environmental sustainability but given its complexity it is hard to believe that trading and subsequent administration will really be conducted in this way. If it is not, however, the reassurance provided by the demanding list of pre-conditions that must be satisfied will have served as nothing more than a smokescreen behind which simplified but often much less environmentally benign transactions are likely to take place. It is hard to avoid concluding that if the NWI system as described is needed for water trading to be environmentally beneficial then this is, in effect, a statement that water trading under achievable standards will be bad for the environment in many instances. These uneasy compromises suggest unresolved tensions between the desire to promote economic activity by strengthening or creating property rights, and the legal responsibility of Australian governments to manage water resources for the benefit of society as a whole.
As already discussed these tensions are to be resolved through the development of comprehensive water plans in most cases administered at the regional level. An example of what will involved in implementing the NWI is the process agreed for bringing activities in dryland parts of catchments into the new water entitlement system (NWI 55-57). At a time when the sharing of water resources is becoming increasingly contested and research has shown that some so-called dryland farming activities have significant impacts on in-flows, it is understandable that governments would want to extend their regulatory regimes to manage these factors. Left unchecked they could have a substantial negative impact on the quantity and quality of water supplied to towns, irrigators and other users and on the capacity to protect the environment.

Under the system to be established under the NWI, as soon as extractions in a region with a water plan exceed levels that are environmentally sustainable, ‘or the system is approaching full allocation’, new production activities that will cause significant further reductions in in-flows to surface or groundwater systems will need to purchase a water access entitlement. (If over-allocation is not a problem such a purchase will not be necessary.) The process of defining the sustainable extraction level is difficult enough but how close does the approach to full allocation have to be before the purchase of water entitlements becomes necessary? The formula also refers to allocation rather than the actual rate of extraction and historically there have often been substantial differences between the two.

Implementation of this policy will also require a more detailed and sophisticated understanding of hydrological systems than is available in most catchments. Without that it will not be possible to define the threshold beyond which purchase of an entitlement is necessary. Under most established water management systems monitoring was focused on in-stream flows and distribution points to and from irrigated properties. The monitoring needed for water management that takes into account activities in the so-called dryland sections of the catchments will have to be much more comprehensive. It will need to record water movement over and through the landscape in ways that have previously only been documented under research conditions.

Distinguishing between over-allocated catchments and non over-allocated catchments is understandable as a political strategy needed to gradually introduce the new approach but it will create a legal quagmire for researchers, managers and investors. How will disputes about such issues be managed under the new system with its greater clarity of rights, better avenues for appeal for those directly involved and for third parties who previously had minimal opportunity to object? The fact that the conflict will be over rain falling on the area in question rather than water diverted through pipes and channels will also add to the tension. Until recent changes regarding the regulation of overland flows in New South Wales and Victoria, rainfall has not previously been estimated and made subject to detailed external management and potential water charges, so significant cultural change within rural communities will be required to win acceptance. It is also likely that this new system will create strong economic incentives for the managers of activities such as new forestry plantations to take legal action to resist the transition from the below-allocation regime where rain water is free and apparently unlimited, to the near and above-allocation situation where they will have to purchase high-cost water entitlements.
The simplest way to oppose such a decision will be to question the science used to calculate the threshold dividing the two regimes.

The complexity of the water management issues that the NWI attempts to confront is highlighted by the difficulties involved in defining environmental sustainability and the ways in which it will be protected. While there are some sections that indicate a broad conception of what is involved in environmental sustainability, there are other parts that tend to suggest that ensuring inflows at least equal outflows will be enough to achieve that condition. Issues such as maintaining or restoring a more natural pattern of seasonal flow or protecting the interrelationship between streams and their floodplains are touched on only very lightly. Concern for water quality, including salinisation, is also more implied than stated in the NWI. On the other hand the National Principles for the Provision of Water for Ecosystems, upon which the NWI is based to a significant extent, does recognize many of these issues quite explicitly. A confident assessment of this aspect of the NWI will need to wait until implementation is further advanced.

The NWI has the potential to produce great benefits if implemented as a comprehensive package. If, however, the environmental protection provisions that it includes are allowed to wither because they are too difficult to implement, then there is likely to be further environmental decline. Many sections of the NWI appear to require significant research in the catchments that will be affected before they can be activated. Some indication of what this will involve is provided by the list of essential components of the new water plans that have to be prepared as a pre-requisite for the granting of perpetual water access entitlements. According to paragraph 25 of the NWI these plans will need good quality information about future risks to flows and diversions, be based on a detailed understanding of the regional characteristics of the hydrological system in question, take account of Indigenous interests, define and manage surface and groundwater systems conjunctively to the degree that they are connected taking account of areas of ‘high conservation value’ and be able to ‘protect the integrity of water access entitlements from unregulated growth in interception through land use change’, (ie from changes in land use in the non-irrigated parts of the catchment). Water plans are also to contain an assessment of the quality of information upon which they are based, a relatively new demand in the notoriously imprecise field of natural resources management that will require specialist skills rarely applied to that activity in the past.

A review of existing legislation, agreements, policies and regulations to make it compatible with the NWI was agreed in principle in paragraphs 13, 14 and 27. Many changes to legislation, policy and regulation will be required to create a seamless national system (with different changes needed in different states). Will this be done by amendments to existing legislation or by introducing identical parallel legislation as with the MDB Agreement? If by amendments or different acts in each of the jurisdictions, what processes will be used to avoid creating a new generation of variations, subtle and not so subtle, in water and natural resources management legislation throughout Australia? Possible avenues that could be used to resolve these issues can be identified in the NWI, but they are not very specific.
Considerable institutional development will be required to make the NWI work effectively. Starting at the top, the Natural Resources Management Ministerial Council will be given an enhanced role as the body responsible for overseeing implementation of the NWI. In support will be the new National Water Commission. The national government is providing the funding and is responsible for appointing four of the seven members of the commission including the chair. Commissioners are selected on the basis of their skills in the areas of ‘audit and evaluation, governance, resource economics, water resource management, freshwater ecology and hydrology’. The NWC has been assigned a comprehensive reporting and coordinating brief and it is likely that its role will expand to provide support to regional catchment authorities as they struggle with the onerous implementation agenda. In addition, it is not clear to what extent the accreditation and evaluation of proposals and implementation plans by the NWC will be ‘desk top’ only or whether there will a capacity to inspect implementation in situ and conduct independent investigations.

Another area of activity that will make heavy demands on funds and skilled staff is the transfer of the many different types of existing entitlements to the single new nationally consistent system of entitlements. The NWI appears to underestimate the complexity of transferring entitlements from the many scores of old systems (the number is unknown but growing with continuing research) to a new nationally consistent system. Who will be doing the detailed work negotiating the exchange of old entitlements to new? Documentation of the large number of existing systems of entitlement is poor and widely dispersed. In addition, the old entitlements are silent about many of the features that are to be detailed in the new entitlements. In practice, there is little available independent capacity to supervise these transfers and protect the interests of taxpayers, future generations, this generation in the future and the environment.

Central to the new policy are the water plans and the need for institutions that can ensure that they are comprehensive and implemented in practice. In most states in the MDB the long-established state government water management agencies have largely been dismantled and regional catchment authorities put in their place. Water management is now increasingly dominated by new and relatively untried institutional arrangements and unless or until they can be made effective, goal and target setting will have little effect in practice. Yet the subject of institutional development is rarely mentioned in the NWI beyond the very limited matter of measures to facilitate water trading. This is a major omission in that it is hard to see these issues being dealt with in any other policy context apart from that being created by the NWI.

The policy and management context within which regional natural resources management bodies such as regional catchment authorities have to operate is extraordinarily complex. Much of the discussion about water management gives the misleading impression that interaction between the Commonwealth and state levels is highly structured but the reality is much more elusive. The independent centres of sovereign power provided by the Commonwealth and state jurisdictions create focal points around which contending interest groups arrange themselves, moving from one to the other as their members make strategic decisions about alliances and about how best to promote their goals or block those of others.
The new regional organisations are formally subordinate to state governments but have independent corporate standing, sometimes get Commonwealth funding and have ready access to state and federal parliamentarians representing their areas. In practice, decisions are not made through a top-down process but are the product of complex cycles of interaction in which the participants have varying degrees of influence but no single voice is dominant. Policy development and management relevant to water now involves complicated interactions between a large number of individuals, groups, organisations and institutions including governments. The Commonwealth government supplies the bulk of project funds to a variety of recipients but usually has to rely on indirect processes of accountability to influence implementation. States have substantial direct regulatory power but limited funds. Research bodies and research and development corporations can provide findings that can bolster some positions in public controversies, discredit others and sometimes shift the basic assumptions upon which such debates are conducted.

Even more politically active are the industry bodies and large companies emerging as irrigation based agriculture becomes more business orientated. There are also non-government organizations such as the Australian Farmers Federation and the Australian Conservation Foundation that influence the wider electorate and whose support is needed by governments for major initiatives. In addition, local governments, although largely ignored by policy makers involved with environmental issues, have planning powers that can play a decisive role at the district level. Largely excluded from all these interactions are members of the general community. They tend to be involved only very intermittently but when activated in the mass can be a decisive and unpredictable political force.

The most obvious point where all these contending forces and influences can be integrated into a single coherent policy is at the regional level (rather than national or state). Many spheres of governance have an interest but none have the same need to coordinate the whole as do the people who will have to live with the immediate consequences. In many if not most regions there are serious questions about whether the necessary human capacity is available to undertake this difficult integration and coordination task.

An issue that has been largely ignored so far in the Australian water debate is the shortage of skilled people able to do the range of tasks required for contemporary water management if it is conducted at the level required by the NWI. Management of hydrological systems is much more complex than it was only a few decades ago. Most regions of the MDB are now severely modified and more subject to competing pressures than was the case in the past. Experience with these systems when they were less modified is not always a reliable guide for the present and future. In addition to long standing issues related to the level of extractions and salinisation, the list of water management issues in the MDB in the early twenty first century now extends to acid 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. Management is made even more complex by the fact that many of
these problems involve different levels of government, occur on private land or are influenced by the activities of commercial companies.

Some of the skills required to deal with these issues were listed in 2002 by David Dole, then the General Manager of River Murray Water, the operational arm of the Murray-Darling Basin Commission. He explained that the future water manager will have:

- technical knowledge of the hydrology and the hydraulics of whole river systems including their floodplains
- technical knowledge of whole catchment land/water processes
- technical engineering skills relevant to constructing, operating and managing physical works
- understanding of the biophysical relationships between water, land and environment, including skills in assessing the impacts of changing flow regimes on river ecosystems
- understanding of the water needs of natural systems as well as those of consumptive users
- technical skills in improving the efficiency and effectiveness of the processes that convey water from storage to root zone
- technical skills in managing and treating drainage waters and in achieving effective surface or sub-surface drainage
- a commitment to creating sustainable natural resource systems whilst also achieving reasonable economic outcomes
- the ability to work with communities to jointly build a sound knowledge base which will underpin the negotiation of future actions
- the confidence to recognise the limits of current knowledge of the impacts of society on natural systems and the integrity to recognise and promote the need for change.

Where will these new super water managers come from? Future demand will be much greater than now but there are already serious shortages of people with the necessary skills. This personnel gap is emerging at the same time as similar shortages are becoming serious in many other spheres of Australian life. Whether the subject is social welfare, transportation, medicine, engineering, business or sports administration, the level of skills required has increased dramatically in recent years. These shortages point to under-investment in Australian education and related services in all spheres and at all levels. Government policy emphasizes the need to increase the number of people in the work force but to manage water systems effectively, along with all the other areas of expanding need, it will be essential to invest much more in also building their capacity. Shortage of skilled personnel to manage Australia’s highly modified hydrological systems, which is already making itself felt, could well prove the greatest source of risk to the NWI and Australian water management in the medium term.
The present regime for managing water resources is characterised by a number of distinctive features:

- A fundamental or radical right vested in the state or territory to control or manage water and water resources
- This right must be exercised only in accordance with the statutory regimes enacted by the legislatures
- The management of water resources is directed at their sustainable use in accordance with a complex range of responsibilities for planning the management of water resources and implementing those plans through a complicated set of potentially enforceable duties imposed on both the public and private sectors
- A series of rights and correlative duties in relation to taking, storing and using water for consumptive and non-consumptive purposes together with rights to receive water for a range of consumptive purposes
- The formulation of a complex set of rules, including rules permitting and regulating trad in water rights, according to which these rights are able to be exercised and these responsibilities discharged
- These rights and duties protect the interests not only of the public and private sectors in general but also of the Aboriginal peoples of Australia.

Fisher then explained that in addition to their incorporation into law implementation of these principles into management practice depended upon the development of a large body of supporting regulations and procedures. It would seem that the potential gap provided by that double requirement has allowed some jurisdictions at least to espouse sustainability in theory but maintain the ancien régime in practice.

At the time that it came into force the New South Wales Water Management Act (2000) was widely acclaimed as an impressive foundation for sustainable water management but its principles did not extend through to policy and management. In 2004 the National Competition Council released its assessment of the performance of the New South Wales government against the goals of the Council of Australian governments 1994 rural water reform package. All states were supposed to be assessed in 2003 but New South Wales was not ready in time. In commenting on the deferment the NCC was critical of that state’s continuing lack of preparedness twelve months later. Unshackled by commitments such as the 1993/94 management rules that are basic to the Cap formula applied in the MDB, the NCC report explained that it was looking for the following characteristics in water planning:

- Ecological sustainability objectives should be specific to individual systems and contextually consistent with the relevant bio-region

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55 Fisher, D., 2005, pp9-10
- The allocation of environmental water in aquatic systems where there are existing users should be sufficient to achieve a ‘healthy working river’
- The allocation of environmental water in aquatic systems should be at a level that maintains ecological health\textsuperscript{56}.

Evidence of stakeholder involvement was also an important priority, but the NCC was concerned that ‘particular interest groups not be over represented’\textsuperscript{57}. Its comments on the processes by which social, economic and environmental concerns were balanced against each other, are of particular interest:

While the Council agrees with the New South Wales government about the importance of appropriate decision-making processes, it would not consider a process that results in water sharing arrangements that will not (over a reasonable period) achieve a sustainable aquatic system as sufficient because the process would not have achieved CoAG’s objective of maintaining the health and viability of the water source or, in the case of a stressed river, enhancing or restoring the health of the system\textsuperscript{58}.

This emphasis on the need to achieve sustainability in practice as well as in principle is one of the outstanding features of the NCC’s approach to the 1994 reforms and also of the NWI.

Under the new water plan for the Gwydir River the proposed water extraction limit is 388 GL per year which represents a 6.5 percent reduction compared with what is permitted under the MDB Cap\textsuperscript{59}. In examining the New South Wales plans the NCC made considerable use of a detailed state government study of river health conducted in 1998\textsuperscript{60}. During the period 1990 -98 the NCC report noted the average extraction limit was 220 GL per year and that the 1998 river health report stated that ‘there is clear evidence of increasing stress within the river and in particular in its important wetland areas’. The NCC report commented that the proposed new limit is nearly twice that at which there was evidence of environmental stress. The NCC was also concerned about changes to seasonal flow patterns. The new Gwydir plan will reduce very high flows to only 10 percent of what they would have been pre-development while very low flows are to be increased ten times compared with the pre-development pattern, in other words a reversal of the seasonal pattern of flow. On considering the plan as a whole the NCC concluded that:

New South Wales did not provide evidence to support the sustainability of the long term extraction limit and other rules established under the plan including to show that the plan adequately addresses seasonality and flow variability\textsuperscript{61}.

\textsuperscript{56} National Competition Council, June 2004, \textit{New South Wales: allocation of water to the environment}, p. 9.
\textsuperscript{57} National Competition Council, June 2004, \textit{New South Wales: allocation of water to the environment}, p. 10.
\textsuperscript{58} National Competition Council, June 2004, \textit{New South Wales: allocation of water to the environment}, p. 22.
\textsuperscript{59} National Competition Council, June 2004, \textit{New South Wales: allocation of water to the environment}, p. 40.
\textsuperscript{60} Dept of Land and Water Conservation, 1998, \textit{Stressed rivers report}.
\textsuperscript{61} National Competition Council, June 2004, \textit{New South Wales: allocation of water to the environment}, p. 38.
The NCC also noted with disapproval that this plan like the other water plans considered in its report ‘does not provide for changes to the extraction limits and flow rules during its ten year life time’ should there be evidence of environmental decline or new knowledge affecting the definition of what is environmentally sustainable. A comment made in regard to many of the plans was that environmental water was the water left over after supply to diverters, rather than the other way round as is required under the NWI where the size of the consumptive pool depends on what is available after the requirements for environmental sustainability have been determined (for whatever level of modification had been negotiated through the regional catchment process and as defined in the relevant water plan).

The assessment of the NCC report of the Namoi water management plan was similar. It noted that the long term extraction limit under the new plan is to be 238 GL. This is a 7 percent reduction on what would be available under the MDB Cap but, the NCC notes, it is almost a third higher than average extractions between 1990 and 1998.

Of that earlier period the river health assessment had found that:

There is clear and increasing evidence of the problems over water use is causing to the health of our waterways, wetlands and billabongs in the Namoi and elsewhere.

The NCC report concluded with respect to the plan for the Namoi:

New South Wales did not provide evidence to support the sustainability of the long term extraction limit and other rules established under the plan, including to show that the plan adequately protects low flows.

The NCC report was more favourable in its assessment of the Lachlan Water Management Plan, but less so of the plan for the Murrumbidgee.

The overall conclusion of the NCC report was that ‘the available evidence indicates that New South Wales has not gone as far as possible to provide water to sustain ecological values’ and it gave advance notice that unless there was greater progress they would be recommending a ‘substantial suspension or reduction in competition payments’ in their final report due in 2005. Subsequently, in 2005 competition payments to New South Wales were reduced by 10 percent or nearly $26 million (later adjusted to $13 million) as a result of its failure to satisfactorily implement this section of the CoAG program.

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62 National Competition Council, June 2004, New South Wales: allocation of water to the environment, p. 36.
63 National Competition Council, June 2004, New South Wales: allocation of water to the environment, p. 43.
64 National Competition Council, June 2004, New South Wales: allocation of water to the environment, p. 44.
65 National Competition Council, June 2004, New South Wales: allocation of water to the environment, pp. 28-29.
A naïve expectation might be that in recent years water legislation has slowly become more responsive to environmental concerns but that the explication of operational principles and their integration into detailed policy is still vague and tentative and will require considerable development before there is a substantial impact on management practices. In practice, however, in the case of New South Wales at least, the story is one of retreat rather than slow progress. The original New South Wales Water Management Act (2000) was a comprehensive response to the wide range of issues involved and would probably have been compliant with the NWI approved four years later. Subsequent amendments, however, some of them passed since the release of the NWI, have eroded key provisions so that it is now clearly non-compliant.

This progression was examined by Alex Gardner in a recent paper discussing environmental water allocations in Australia. The history of amendments and court actions discussed by Gardner centred on whether the need to make provision for environmental flows should have priority over consumptive demands. It is particularly relevant to the NWI which is unequivocal in its requirement that flows to maintain environmental sustainability should have priority. According to Gardner the original Act appeared to meet this standard but amendments in 2004 gave the minister more discretion.

It is arguable that the original terms of the Act created a statutory prescription of a basic EWA (environmental water allocation) that was to be maintained at all times, which the 2004 amendment repealed in favour of a mere requirement that a management plan commit water for fundamental ecosystem health at a level that the minister thought fit.66

But what would happen if the minister failed to meet even this reduced requirement? That was tested by the NSW Nature Conservation Council in the Gwydir River Case (2005).67 In Gardners words:

The court rejected the minister’s argument that the Act did not require the identification of any actual volume of water and that an ‘abstract concept’ of water available for fundamental ecosystem health would suffice. The Court said:

The idea of commitment’ is quite inconsistent with any abstract or theoretical concept of water. What must be identified is actual water. The words ‘establish’ and ‘maintain’ are not suggestive of anything other than actual water.

What is required is water that is constantly provided for and which absent acute drought conditions, will in fact be available to protect ‘fundamental ecosystem health’. To the extent water is present at all, priority is to be given to fundamental ecosystem health’

On other grounds the Appeals Court eventually found for the New South Wales government. Subsequently the High Court granted the Nature Conservation Council special leave to appeal but this was neutered by another amendment that ‘redefined

67 NSW Court of Appeal 9.
environmental water and inserted a validating provision for management plans.\textsuperscript{68} Gardner’s paper also investigated developments in Victoria and Western Australia and found the situation in those states to be no better.

The capacity of Australian governments to enact laws and regulations in relations to environmental resources such as water at first sight appears to give them great power to change the way people interact with the environment but it has been little used. According to Tim Bonyhady:

> while rarely irrelevant, the law generally provides little more than a loose framework for how policies are formulated and decisions are made. The stronger the law the more likely it is to go un-enforced or be amended.\textsuperscript{69}

A number of reasons for the relative weakness of environmental legislation can be inferred but it is difficult to escape the perception that governments do not assign to this area the same priority that they do to others that are equally hard to regulate but of higher community concern. There seems to be sufficient electoral support to allow governments to introduce schemes that reward change but sufficient opposition to laws that penalise negative behaviour that they avoid using regulatory power whenever they can.

An analysis of recent water management legislation shows that it is not lack of awareness of what is needed to implement sustainable management that is the constraint. What is more wanting is serious conviction that the political risks are worth taking. Given that, what would be the economic impacts if a substantial reduction in diversions was imposed in the near future? A number of recent studies make surprising predictions. A paper published by the Productivity Commission, for example, describing the results of modeling water trade in the southern Murray-Darling Basin, estimates that the impact on the Gross Regional Product (GRP) of a 10 percent reduction in water extractions combined with open intra and inter-regional trade would be 0.52 percent. For a 30 percent reduction in water availability the reduction in GRP would be 2.02 percent.\textsuperscript{70}

This prediction of relatively small negative impacts by the Productivity Commission is supported by other studies. An investigation conducted for the Murray-Darling Basin Commission found that a reduction in diversions for irrigation of 500 GLs as a result of the Living Murray project would result in a less than 1.2 percent reduction in total gross margins. It was further predicted that this loss would be lowered by up to a third if water markets were opened up.\textsuperscript{71} A study by ACIL Consulting in 2002 of the impact of reductions on irrigation in New South Wales produced similar findings.\textsuperscript{72}

These studies beg many questions, including some raised by the discussion earlier in this chapter about the effort to promote more widespread water trading, but they do

\textsuperscript{68} Gardner, 2005, p 11.
\textsuperscript{70} Peterson, D., Dwyer, G., Appels, A., Fry, J. M., November 2004, Modelling water trade in the southern Murray-Darling Basin, pp. 29-41.
\textsuperscript{71} Murray-Darling Basin Commission, 2004 July, Scoping of economic issues in the Living Murray, pv.
\textsuperscript{72} ACIL Consulting, 2002, Economic impacts of the draft water plans, p. iv.
indicate that the economic effects of reducing diversions could be much less than
some irrigation groups suggest.

There are reasons to suggest, however, that small as the predicted impacts may be,
they probably still exaggerate the possible negative results of a reduction in diversions
in that they do not take into account the many economic benefits that could come
from such restraint. The Productivity Commission study excluded consideration of the
economic impact of the further deterioration in the environmental condition of the
MDB that is predicted to result from today’s level of extractions. Given the long lag
times in these riverine systems between cause and effect it will take some years before
the level of degradation that is apparent and measurable will match development
pressures and rates of extraction as they are now. The current environmental
condition of the MDB reflects the impact of lower rates of extraction than those being
experienced in the mid 2000s. To compare the costs and benefits of different
scenarios, an estimate of the economic cost of that future degradation should be
factored into the business-as-usual baseline.

The business-as-usual approach poses a number of threats to regional economies.
Despite the well-chronicled poor environmental state and continuing decline of the
MDB’s river systems, many urban centres in the region are still pleasant places to
live, attracting significant numbers of retired people. Further environmental
deterioration is likely to reduce this attraction and given the expectation that
Australia’s retired population will expand, and their propensity to migrate if
dissatisfied, could result in population decline. Regions where the population is
contracting find it difficult to attract investment as governments and large companies
reduce services, businesses struggle to be profitable and property values fall,
sometimes dramatically. The Productivity Commission modeling also appears to
exclude the impact of future deterioration on tourism and recreation, two activities
that are heavily dependent on attractive riverine environments and which are
economically significant in the MDB.

On the other side of the equation, what will happen if the necessary steps are not
taken to achieve environmental sustainability? Some of the possible consequences
were outlined by one of the consultancy groups who assisted with the five-year
review on the MDB Cap on extractions undertaken in 2000. Discussing the potential
implications for the MDB should it fail to implement an effective Cap and other
programs for environmental rehabilitation, Marsden Jacob, the authors of the second
companion report to the review, predicted that resource sustainability would become a
major issue. Under those circumstances they thought that increased irrigation
development would undermine the security of established producers and provide a
disincentive to new entrants. Degradation of the riverine environment and water
quality would proceed at an accelerating pace and there would be increasing tensions
between irrigation groups and surrounding regions as water supply security declined.
Water trading would become more aggressive and the incomes and viability of
irrigated enterprises and communities across the Basin would be increasingly
sensitive to seasonal and climatic variation. Ultimately, as end of valley flows
continued to fall and the damage to riverine environments became stark, irrigation

communities would become increasingly alienated from the wider society, a bleak prospect for all concerned.
Section Three - Defining Sustainability

- The effort to achieve environmental sustainability is part of a world-wide campaign (Note Agenda 21 adopted by the Rio Earth Summit of 1992).
- Environmental sustainability in Australia’s hydrological systems will require substantially lower levels of consumption of water than now.
- Implementation of the management programs required for the achievement of environmental sustainability will depend on major cultural shifts.
- Environmental and water management are not yet mainstream activities as shown by the level of funding programs and the rudimentary development of the needed regional institutional arrangements.
- Minimal requirements for environmental sustainability:
  - Policy and management must be system-wide
  - the system must be stabilised at whatever level of modification is defined as appropriate
  - the level of modification must be politically acceptable to the wider public as well as the communities most directly involved.
- In addition to meeting the minimal criteria listed above attention must be paid to factors such as the restoration of patterns of seasonal flow, improvement of the connections between the floodplain and the main stream channel, erosion in the catchment, reduction in the number of structures interfering with flow and many other factors.
- There has been a lack of recognition of the extent to which the pre-NWI system with its administrative assumptions continues to shape water policy and management.
- The NWI proposes a rights and duties based system that can be enforced by courts but the legislative and cultural foundations are not yet in place.

Sustainability in the context of water planning cannot be separated from the wider international debate about the need for sustainability on the planet. The most prominent feature of the more general debate is the consumption of materials and energy at rates that cannot be maintained. That general factor imposes itself on hydrological systems in many ways. The most obvious is through climate change which in the context of the southern Murray-Darling Basin is predicted to substantially reduce the volumes of available water for both human consumption (direct and indirect for agriculture etc) and for the environment.

There are other impacts, however. Long term sustainable patterns of water management will require stable or probably reducing levels of pressure from economic activity. Economic growth will not need to be reduced per se but it will need to be made compatible with reducing levels of consumption of the ‘goods’ that can be derived from the riverine system (and the consumption of materials and energy in general). In the case of hydrological systems the publicly stated aim is to hold consumption at levels that are substantially lower than what is physically available so that a significant component will be available for the environment and to preserve reliable levels of supply in the future.

This is a very substantial cultural and institutional challenge. The issue is whether water as a common resource can be protected from the fate predicted by Garrett Hardin in his short paper *The tragedy of the commons*. There have been many
successful examples of such restraint in the past within different cultural contexts but can such a system be introduced in a contemporary growth driven economy where, arguably, the primary emphasis of much public policy is the removal of constraints to increased material and energy consumption.

The intention of this project is to explore how sustainability concepts are being included within the established management frameworks that are being applied in these three catchments. That focus points to discussion about what is needed to achieve environmental sustainability and protect resource security, goals that are central to the NWI although yet to be defined. A set of general principles were contained in Agenda 21 the landmark manifesto of the Rio Earth summit in 1992 which has been one of the main influences on recent public policy at all levels of government regarding the management of natural resources. Chapter eighteen of Agenda 21 deals with freshwater issues. It proposed that:

the holistic management of freshwater as a finite and vulnerable resource and the integration of sectoral plans and programs within the framework of national economic and social policy are of paramount importance for action in the 1990s and beyond.  

What would be involved in the implementation of water management along these lines? This question has been the subject of considerable research. Sandra Postel and Brian Richter recently provided a useful summary of this work from an international perspective. Their survey of research into the question ‘what do rivers need?’ traces its history back to a split that developed during the 1970s and 1980s between applied biologists, resource economists and engineers, generally based in water management agencies, and aquatic research ecologists working in universities and similar organizations. The two groups asked different questions and developed different approaches. Those working in water management agencies tended to focus on improving conditions for icon fish species. By contrast, research ecologists investigated the response of riverine plants and animals under a wide range of flow conditions. The former group tended to concentrate on water depth and velocity during times of natural low flow while the latter emphasized the importance of recreating the natural seasonal flow regime.

More recently the applied group has moved closer to the aquatic ecologists but this has not made their recommendations for river management any simpler. The way in which the more holistic approach, with its emphasis on the importance of the flow regime, has evolved is illustrated by the following eight principles developed originally for South African rivers:

- The modified flow regime should mimic the natural pattern
- Natural perenniality or non-perenniality should be retained
- Most water should be harvested in wet months
- The seasonal pattern of higher base flows in wet seasons should be retained
- Floods should be allowed in wet seasons
- The duration of floods can be shortened but not by much
- It is better to have some floods in full and eliminate others than to reduce them all by an even amount

75 Agenda 21 chapter 18 para 18.6.
76 Postel, S., Richter, B., 2003, Rivers for life.
The first, or one of the first, floods of the season should be fully retained. According to Postel and Richter this approach to re-creating natural flow patterns is widely recognized by ecologists elsewhere as suitable for regions dominated by variable climates (such as Australia). For heavily-modified rivers the issues are more complex. A key general principle, however, is that river managers should attempt to restore more natural patterns of flow. The corollary is that action that increases the difference between what happens as a result of development activity, and the natural flow pattern that existed before development, is likely to push a hydrological system to a more degraded environmental condition.

Australian researchers have been closely involved in this research and their influence is reflected in government policy in recent years. The NWI builds on earlier work undertaken on behalf of CoAG with regard to the Australian water industry. In particular, it cites the Tripartite agreement (January 1999) made between representatives from the National Competition Council, the high level Steering Group on water (augmented by representatives from ARMCANZ and ANZECC) and the Committee on Regulatory Reform. The National Competition Council (NCC) is the more senior body behind the National Water Commission and until the creation of the latter organization it was responsible for implementing CoAG policy with regard to water. Its analysis of water issues is significant as an indication of the long term trajectory of government policy. The NCC report into compliance by New South Wales with the 1994 water reform program explains that at the core of the Tripartite Agreement were the national principles developed by ARMCANZ and ANZECC. In particular the NCC report drew attention to principles 4, 5 and 7:

(4) In systems where there are existing users, provision of water for ecosystems should go as far as possible to meet the water regime necessary to sustain the ecological values of aquatic ecosystems whilst recognizing the existing rights of other water users.

(5) Where environmental water requirements cannot be met due to existing uses, action (including reallocation) should be taken to meet environmental needs.

...  

(7) Accountabilities in all aspects of management of environmental water should be transparent and clearly defined.

These principles reflect the ecological approach described by Postel and Richter. They are further emphasized in the NCC report’s discussion about the approach that should apply to modified or working rivers. As a starting point for the definition of ecological health in such rivers, the NCC used the formulation adopted for the ANZECC National Water Quality Management Strategy and the National River Health Initiative. For those policies that condition is:

the ability of an ecosystem to support and maintain key ecological processes and organisms so that their species composition, diversity and functional organizations

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78 NWI, 6; National Competition Council, June 2004, *New South Wales: allocation of water to the environment*, p. 5.
are as comparable as possible to those occurring in natural habitats within a region\textsuperscript{80}.

Recognizing that in its comprehensive form this could only be applied to rivers in pristine condition the NCC report then drew on the work of the Expert Reference Panel established for the Living Murray Initiative (2003) that defined a healthy working river:

as a river that is managed to provide a sustainable compromise between the condition of the river and the level of human use. A water regime based on the healthy working river approach would not return an aquatic system to pristine condition. It would, however, sustain ecological objectives indefinitely. The Living Murray Initiative advocates a holistic approach, with the water regime, condition of floodplain wetlands and in-channel habitats and water quality all considered. The end point will not be a pre-European flow regime. Rather it will be one that meets the tests of long term ecological sustainability\textsuperscript{81}.

A number of features stand out in this discussion by the NCC. The importance of maintaining a wide range of biophysical features of the pre-development river is emphasized as is also the requirement that its environmental condition should be stable and not continuing to decline.

Central to the discussion about the management of working rivers, and a fundamental theme of the NWI, is the need to negotiate compromises that balance social, economic and environmental concerns. Before we can develop and implement plans that effectively take account of all three elements there will need to be a substantial evolution in the public policy process. According to the then Chair of the Community Advisory Committee to the Murray-Darling Basin Ministerial Council, Leith Boully, and Steve Dovers, we are only now beginning to realize that changing the way we manage natural resources is less about the resources and more about people and their behaviour. However, our understanding of what motivates people to change and of the mechanisms that influence and assist behavioral change is poorly developed. They think that our commitment to, and understanding of, genuine public engagement is little more than rhetoric. A significant proportion of the community is apathetic or resistant to change until there is a need to respond to a crisis. Market prices for food and fibre do not cover the full cost of production and farmers are forced to run down natural capital. River health is declining, and competition for water is becoming intense. All in all, the cumulative offsite impacts of two centuries of agricultural and urban activity have created catchments where land resources are degrading and polluting our rivers with salinity and other contaminants.

In the opinion of Boully and Dovers, the management of natural resources is not entrenched as a core responsibility for public investment in the same way as health and education. Instead it depends on grant schemes, sell-offs and handouts at election time. Resource and environmental management is fragmented across jurisdictions, sectors, portfolios and issues. Property rights and obligations are at best ill-defined and there is no common currency to describe water or land entitlements across the Basin. There is continuing and increasing conflict over resource use and the sharing of

\textsuperscript{80} National Competition Council, June 2004, \textit{New South Wales: allocation of water to the environment}, p. 8.

\textsuperscript{81} National Competition Council, June 2004, \textit{New South Wales: allocation of water to the environment}, p. 9.
costs and benefits between individual farmers, communities, and states. They conclude that delivery of catchment targets for salt, water flow etc will require far more sophisticated governance arrangements at catchment level than those now in place.

**Minimal Criteria**

There are three minimal criteria that need to be met for a modified environmental system to be defined as environmentally sustainable. First, the level of environmental sustainability should be stable, durable and maintainable over a reasonable period of time and not in a state of continuing decline. There is a considerable body of literature discussing the meaning of the term ‘sustainability’ but no suggestion that it is compatible with a situation that is continuing to deteriorate.

Second, the condition of environmental sustainability would need to be system-wide. The fundamental importance of applying an ecological systems approach to environmental questions is well established in the research literature and it would seem a reasonable corollary of this that management should also be systems-wide. More specifically in the case of water, the National Water Initiative appears to make no provision for a situation where a specific site is defined as sustainable (perhaps as a result of a locally focussed management regime) while the wider system of which it is a part is in a state of continuing decline. This is made clear in many sections of the NWI. It requires ‘the return of all currently over allocated or overused systems to environmentally sustainable levels of extraction’ and ‘recognition of the connectivity between surface and groundwater resources and connected systems managed as a single resource’. Similarly, the planning framework is to ‘implement firm pathways and open processes for returning previously over allocated and/or overdrawn surface and groundwater systems to environmentally sustainable levels of extraction’. These are just a few references among many that make it clear that a systems approach is required by the NWI.

It should be noted that this formulation of minimal requirements for achieving sustainability assumes the availability of a strong capacity for scientific research and comprehensive monitoring. Given that the historical record has shown that Australian ecosystems are highly variable, poorly understood and subject to unpredictable threshold changes, continued substantial investment in science to gain a better understanding of ecosystem dynamics is essential. Effective implementation depends on a detailed and well informed understanding of the ecosystems in question so that the requirements for stability are understood and effective management programs can be established. Crucially, when goals and management plans are being negotiated, substantial scientific input will be required to make sure that economic and social considerations do not result in compromises that are incompatible with maintaining

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83 Young, W.J. (Ed.), 2001, *Rivers as Ecological Systems*. In particular see chapter one ‘The rivers of the basin and how they work’, pp. 3-44.
84 Council of Australian Governments, 2004 June, *Intergovernmental Agreement on a National Water Initiative*. (The notation used throughout the thesis is NWI, number of paragraph, number of letter of subsection ie NWI, 63, ii (b).
85 NWI, 23, iv and x.
86 NWI, 25, v.
the environmental resource in a long term stable condition. Given the long time lags that often exist between actions and their environmental consequences, it is easy for the rhetoric of the moment to disguise such a result.

Third, the level selected as the appropriate degree of modification would need to be politically viable for a reasonable period of time measured in decades at least. This would require effective institutional arrangements able to both negotiate the various compromises involved in defining the degree and nature of the modifications to be imposed on the environment and also to defend the resulting agreements. These arrangements would need to be solidly based on cultural values that are likely to attract long term support in the wider society and not just fragile ad hoc deals opportunistically made between key interests. The latter are not likely to provide the long-term security desired by production based groups.

The three criteria just outlined are essential but not sufficient to constitute a definition of environmental sustainability. Many other considerations need to be taken into account. Postel and Richter have highlighted some and the ecologist Peter Cullen has indicated others. According to Cullen rainfall and stream flow in Australia is very variable, and is probably changing, so planning around mean flows is inappropriate. Attempting to even out water availability has significant costs in that large volumes must be stored and there are unavoidable major evaporation losses. River health is determined by the flow regime, contaminants in the water and the habitats created by the ecosystem. These elements are affected by structures that restrict access to habitat, alter stream flow patterns and by land uses that release sediment, nutrients and other contaminants.

Water planning needs to be at the whole system level. Managing irrigation salinity in isolation from dryland salinity has been ineffective as is also managing surface water in isolation from groundwater. It is imperative to plan for the entire river, including its estuary, rather than for isolated sections. Cullen explains that this is the foundation of the movement towards integrated catchment management that has developed in Australia over the past 20 years, a process that is still hampered by state boundaries and the inability to take a holistic view. He stresses that rivers and their floodplains need to be understood as ecological systems not just as hydraulic structures.

In the case of water, political controversy over river management will continue to grow if the core issues are not resolved to the satisfaction of the wider electorate. This means that diverters will experience further loss of security of entitlements because the overall system of water management will remain under attack with the prospect that it could eventually be overhauled or dismantled. Firm statements by governments and legislation providing greater legal clarity of entitlements will not alter this reality although they might establish grounds for compensation when governments are forced to make additional retreats in the future.

Central to the debate about the future of water management in Australia is conflict about the cultural values that define what is reasonable and appropriate behaviour in relation to the environment. As reflected in the popularity of phrases such as ‘you can’t be green if you are in the red’ and the rarity of environmental programs that

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involves serious restraint on the ambitions of production-based interest groups, it is still not widely accepted that the first priority for the management of natural resources should be maintenance or restoration of their condition to a stable non-declining state. Almost all recent major Australian natural resources and environmental management policies espouse sustainability in principle, but few attempt to introduce implementation programs on a scale that would make it possible to achieve that goal. In practice, despite the rhetoric, ongoing decline is almost always acceptable. Until this extraordinary dichotomy is resolved in some way it will be difficult to satisfy the third of these three requirements for sustainability, institutions and cultural values that provide political stability.

Water management in the MDB faces many demands that are difficult to resolve. The NWI was designed as a framework that would help resolve these tensions. It combines recognition of the enormous economic benefits to be gained from water with a stress on the need to make the overall management regime sustainable so that the access of a comprehensive range of future users, and current users in the future, will be protected. It also shows awareness that the economic benefits will only be protected if the water management regime put in place under its influence is accepted by the wider community. This means that other claims such as environmental, social, aesthetic and religious, in addition to those with an economic base, whose supporters are able to mobilize significant political support, now or in the future, must be taken into account to some extent. Without broad acceptance by society in general that the water management system is essentially just and equitable, all entitlements no matter what their basis in law will continue to be under political threat of abolition or erosion.

**Lack of recognition of the changes needed**

For over a century Australian water management was run by public officials applying an administrative approach to the distribution of heavily subsidised water. During most of this period it was governments and their officials who led the way in promoting increased water use. As part of the nation building project that extends back to the mid nineteenth century the aim was to use water to create new rural communities. To do this governments actively sought out people who would use the water made available by publicly funded storages and distribution systems. Data about the volumes of water available, where it came from and where it was going, was important for managers but except in times of drought there was little concern about over extraction and compliance issues or the need to balance competing priorities.

In each region the managers of such schemes had considerable autonomy in the way they expanded the use of irrigation water. The result over time was the ad hoc development of many poorly documented entitlement and distribution systems that reflected biophysical variations between regions and the idiosyncrasies of local communities and their water managers. For a number of decades this was less of a problem than it might seem. Expansion occurred during what was a wet fifty year period compared with the first half of the twentieth century. Extractions were still at fairly moderate levels and water trading was minimal. Together, this meant that inconsistencies between regions were not a serious problem.
Today, the context for managing water has altered dramatically. Over more than a decade, Australian governments, both liberal and labor at federal and state levels, have undergone a philosophical transition from one of ‘nation and community building’ the promotion of economic growth. Within this context, water has increasingly emerged as a scarce resource (or commodity), and pressure between competing interests for access to water resources has intensified.

The changes that would result if the NWI is implemented would be profound. Australian governments are using their control of water management to create a rights-based regime based on tightly defined entitlements for recognised stakeholders ranging from irrigators and towns to the environment itself. Rights-based systems have many ramifications, not all of them intended. The new system has very different requirements regarding the quality, range and volume of information that it needs to function compared with the old administrative system that it is replacing. Vague definitions and imperfect information are now a much greater threat to the operation of the water management system than they were in the past. Then, even though available data was often seriously inadequate and the rights and responsibilities of the various stakeholders involved in a given issue were only vaguely defined, water administrators could still make decisions, for better or worse, based on their considered assessment of the issues.

This system is being replaced with a property rights regime that is meant to be largely self regulating. More intractable disputes will necessarily arise, and some of these are likely to end up in the courts to be solved by lawyers and arbitrators rather than by administrators or politicians as in the past. This ever present possibility will shape the way rights and responsibilities have to be defined and nature of the data needed to operate the new system. In this context, previously accepted standards of data and definitions of rights and responsibilities will be grossly inadequate and unworkable. As the history of land and house trading indicates, creating and resourcing institutional processes that will be able to satisfy the new requirements will be a complex task.

Contemporary water management is characterised by the involvement of many institutions with vaguely defined roles. The independent centres of sovereign power provided by the Commonwealth and state jurisdictions create focal points around which contending interest groups arrange themselves, moving from one to the other as their members make strategic decisions about alliances and about how best to promote their goals or block those of others. In practice, decisions are not made through a top-down process but are the product of complex cycles of interaction in which the participants have varying degrees of influence but no single voice is dominant. For any particular region with its own characteristics the most obvious point where all these contending forces and influences can be integrated into a coherent policy is at the regional level (rather than national or state). Many spheres of governance have an interest but none have the same need to coordinate the whole as do the people who will have to live with the immediate consequences.

In the case of the NWI the meeting point for all the competing tensions involved in water management is the water plans that are to be prepared for each hydrological system. Water planning is the central organising device for the NWI but progress with their implementation has been slow. This was indicated in the October 2006 National
Water Commission newsletter which reported the findings of the Australian Water Resources 2005 audit. Among other things it found that only 18 per cent of surface water management areas and 33 per cent of groundwater management units had a draft or final management plan at that time.

One of the most significant issues is the failure so far to provide the legislative underpinning that the new system requires. As Douglas Fisher has explained, the system being established under the NWI is based on the assumption that environmental sustainability and resource security will be defined by statute in a form that will be defendable in courts. Although only a small percentage of transactions will involve legal action it is that possibility that will shape the way rights and responsibilities have to be defined. However as Alex Gardner has explained none of the nine jurisdictions involved with the NWI have yet incorporated the requirement to achieve environmental sustainability into legislation let alone the supporting detail that will be required to make good on the general principle. According to his analysis the closest that any jurisdiction has come to achieving this minimum standard was the New South Wales Water Management Act (2000) but in his assessment it has since been significantly weakened by amendments.
Conclusion

The collective failure of Australian governments to implement the NWI has been overwhelming. The original intent was that the NWI would provide a framework that would result in systems of water management within which:

- allocations would be restrained at levels that would achieve or preserve environmental sustainability (at the very least stability of environmental condition and resource security)
- there would be clearly defined water entitlements that could be legally defended, and
- the rules applying to decision making and management would be transparent so that stakeholders know what to expect under a wide range of predictable circumstances (thereby eliminating most of the scope for discretionary decision making previously exercised by agency water managers and government ministers).

None of these principles have been put in place. Consequently the system is still dependent on government ministers exercising substantial discretion in response to the frequent unpredictable crisis that result from the instability created by over allocation. Documenting this situation was not the aim of this project but the process of conducting the required research revealed considerable evidence that supports this conclusion. Convincing the public and the governments involved that this is the case, however, will require overwhelming evidence and exhaustive exposition. It is essential that this be done because the cost of failure to implement the NWI will be the destruction of the biophysical base and resource security upon which many irrigation communities depend and the severe degradation of many environmental assets of national and international importance.

The aim of this project was to develop useful recommendations regarding the definition of environmental sustainability for Australian water managers, given that all of them are required to base their work on water plans designed to achieve and maintain that condition. The project has found no indication, however, that water managers in the three sub-catchments in the three jurisdictions (or apparently anywhere else across Australia) are attempting to achieve that goal beyond the limits of the possible within the existing legislative and administrative frameworks. Further, the work of Fisher, Gardner and others has shown that what is possible is significantly lacking as a foundation that will support efforts to develop and implement water plans designed to achieve sustainability. This also accords with the assessment by Peter Cullen, National Water Commissioner, at a presentation to the Brisbane Riversymposium in September 2006 when he commented that he doubted that ‘we yet have any water plans that are NWI compliant’.

The NWI requires that the concept of environmental sustainability for a particular hydrological system should be defined through a community/political process that balances off social, economic and environmental goals in a way that is biophysically stable for the agreed level of modification. It seems, however, that there is no existing constituency actively involved in defining environmental sustainability for Australian hydrological systems. According to the NWI defining environmental sustainability is supposed to be a community driven process so the first task would appear to be the
creation of that constituency. After that has been achieved we can begin the process of interacting with it and defining environmental sustainability (the aim of this project).

There is still very little understanding of what is required to implement the NWI. The starting point should be a clear understanding of the current situation. In essence Australian water management is still conducted on the same premises that shaped it for more than a century. During that period the focus was on growth to support new settlements in inland Australia. Issues related to environmental sustainability were not considered for most of that period and when they emerged more recently they were not seen as a threat to production. Achieving environmental sustainability is still seen to be an optional extra not a serious priority. The dismal record of all governments with regard to implementation of the NWI shows that this perspective continues to shape policy and management.

Despite the rhetoric regarding the NWI that pervades contemporary water management, governments and most members of the public continue to accept ongoing decline in both environmental sustainability and resource security. Convincing governments and the public that this is the implication of current policy will be a necessary prerequisite for any serious discussion about what environmental sustainability might mean in practice. Unless the problem is acknowledged it cannot be resolved.
Attachment - Case studies

This section of the project brings together case studies from three contrasting regions, the Goulburn Broken catchment in northern Victoria, the Daly-Katherine catchment south of Darwin in the northern territory and the South Australia section of the Murray-Darling Basin. The National Water Initiative requires water planners to develop plans that will result in their hydrological systems being managed so that they are environmentally sustainable at whatever level of modification has been defined as appropriate. These three catchments each pose very different questions about how that principle will or can be applied in practice. Despite some initial development the Daly-Katherine catchment is still in essentially the same environmental condition that it was in before European contact. The Goulburn Broken is a highly modified system that contains one of the nations premier environmental sites the Barmah forest which has been placed on the Ramsar register as a wetland of international importance. The South Australia system is also highly modified but unlike the Goulburn Broken catchment its environmental condition is heavily dependent on policy and management implemented in other jurisdictions upstream.

First Case Study - Goulburn Broken catchment Victoria

The Goulburn Broken catchment is in northern Victoria within the Murray-Darling Basin. It supplies 11 percent of the Murray’s stream flow, about the same as the River Darling before development intensified. The catchment contains a number of major regional cities such as Shepparton and Benalla and is home to nearly 200,000 people. The population is ethnically diverse and well supported by a wide range of educational and community resources and expanding rapidly. More than 800 GL of surface flow and about 45 GL of groundwater is used by agriculture with Lake Eildon the largest storage in Victoria, providing a substantial and previously reliable supply to the region. The asset base of Goulburn Murray Water the water supply agency is about $2.6 billion.

The economic assets of the region are substantial this being one of the most productive in the MDB. The agricultural output of approximately $1.35 billion underpins a regional economy worth nearly $8 billion. The main primary industries are horticulture, dairy, cropping, viticulture, wool, forestry and grazing. Centred on Shepperton is a large fruit and vegetable food processing industry. Other products include milk derivatives, wineries and processed meat. Capital investment in food processing has increased by more than $600 million in the past five years with total employment now about 77,000. New industries such as aquaculture are also expanding rapidly.

Through the Goulburn broken catchment there are more than 400,000 hectares of forest including commercial plantations and many national parks extending across a wide range of landscapes and bioregions including alpine areas where the original native vegetation is still dominant. Many significant native species are present including leadbeaters possum, the mountain pygmy possum and spot tailed quoll. In the mid catchment foothill forests merge into drier woodlands and grassy woodlands.
Closer to the Murray, the flat fertile plains are covered by grassy woodlands with a wide range of tree and shrub species.

Much of the vegetation on private land is severely degraded, however, and fauna habitat has also declined in parallel with the reduction of native vegetation. 98 percent of the remaining patches of native vegetation in the catchment is less than one hectare in size. The conservation status of many species is still in decline with many populations below threshold levels. The decline in extent of native vegetation, however, is now expected to increase in coming years due to replantings many of them focussed on restoring connectivity between patches of habitat. Unfortunately this is not expected to save many species in that it will take up to a century for habitat hollows to appear in the new plantings and with climate change predicted to have substantial impacts.

There are nearly two thousand wetlands extending over a total area of more than 80,000 hectares. Some of these are man made and while many wetlands have been drained others are now deeper and permanent rather than perennial due to changes resulting from water management practices. Many wetlands are affected by increased nutrient loads and salinisation which has caused a significant decline in bird and fish populations. About 30 percent of the streams in the catchment are in good condition as measured against the index of stream condition which takes into account hydrology, physical form (bank stability, influence of artificial structures etc) environmental conditions in the zone alongside the stream, water quality and aquatic life. The catchment supports one of only two viable trout cod populations in the state. In recent years monitoring indicates improvements in a range of environmental conditions in areas in the catchment which have been prioritised for remedial action. The removal of a number of barriers to fish passage in recent years is expected to lead to substantial improvements.

One of the most distinctive features of the region is the Cadell fault a ridge a few metres high that runs north south intersecting the path of the Murray. It resulted from a geomorpholgical uplift which occurred about 20,000 years ago and restricted the flow of the River Murray. The main passage through the Cadell Fault is the Barmah Choke. This narrow channel restricts flows during times of medium and high flow causing flooding through the forest and wetlands to the east that have evolved in response to the frequent flooding regime. During times of high flow much of the water gets downstream via the Edwards River which loops round to the north. The flora and fauna to the east of the Barmah Choke, known as the Barmah Forest has evolved in very distinctive ways in response to these unusual circumstances. Before European settlement these conditions resulted in the region being very heavily settled by Indigenous people.

The Barmah Forest, the largest red gum forest in Victoria, has been placed on the Ramsar register of wetlands of international importance. It contains a highly diverse and valuable range of flora and fauna and after flooding is a major area for bird breeding featuring species such as sacred and straw necked ibis, black and maned ducks, great cormorants, little black and little pied cormorants, white faced, pacific and rufous night herons, yellow billed spoonbills, crakes and rails. An estimated 100,000 ibis nested in the forest during the 1973-75 flood. The forest also preserves many of the most distinctive geomorphological features of the riverine plains,
including the prior streams, lakes, lunettes, ancestral rivers, source bordering dunes and deltaic features. The Barmah forest contains hundreds of aboriginal sites which include burial grounds, mounds, middens, and scarred trees. The Yorta Yorta people have maintained a continuing relationship with the region and are now involved in various ways in its management. The forest also has a distinctive European settler history having been used for forestry, cattle grazing, bee keeping and other activities including many recreational pursuits for well over 150 years.

Threats

The 1999 Victorian Rivers Environmental Report Card stated that less than 30 percent of the rivers in the Goulburn catchment were in excellent or good condition and less than 10 percent of the streams in the Broken catchment were in that category. In recent decades a number of threats have emerged to the region’s productivity. Poorly drained soils, salinization of soils and streams, problems with water quality, soil degradation and ecosystem decline. Although a range of remedial management programs have been implemented problems such as dryland salinity and soil degradation and acidification still pose serious future threats. In addition, the region’s water management institutions are struggling with mixed success to manage increasing demand.

In the medium term the greatest threat to people and the environment in the catchment is considered to be salinisation and water logging, two problems that have temporarily receded due to the drought. There are also major predicted impacts on wetlands which are particularly vulnerable because of they are usually found in low lying parts of the catchment. Estimates of the size of the areas at risk vary substantially although all agree that the figure is large. The area of high water tables in dryland parts of the catchment is predicted to increase from just over one thousand hectares to about six and a half thousand hectares over the coming century.

Dryland areas at risk are even harder to predict but the most conservative estimate is that 30-50,000 hectares of the dryland part of the catchment will be severely affected by 2060 with a much larger area moderately affected. This is predicted to reduce productivity by about $40 million per annum by 2050 with costs within the catchment for damages to roads etc estimated to reach about $250 million. Another impact will be increased salinity impacts on the streams through groundwater drainage. Some 20 percent to 40 percent of the significant wetlands in the region are considered to be at risk. Salinity and water logging are an even greater risk for irrigation a particularly significant activity in this one of the country’s most significant regions for that activity. About 20 percent of the catchment is irrigated with most of it concentrated around Shepparton. Without active management about 65 percent of the Shepparton irrigation region will have a high water table by 2020.

As a result of the horticultural, agricultural and associated industrial activity in the region a very substantial volume of nutrients and turbid water is exported to streams. Just under 300 tonnes of phosphorous and nearly two thousand tonnes of nitrogen are exported from the region each year. This increases the risk of algal blooms downstream. For this region climate change predictions currently do not anticipate changes in overall volumes of precipitation. However increases in temperature and variability and the frequency of extreme events are expected.
Across the catchment there are a range of threats to the environmental integrity of the region. The Barmah forest as a Ramsar wetland at the bottom end of the catchment alongside the River Murray is particularly vulnerable. The biggest single factor has been the impact of the water management regime. It has reduced the frequency and extent of flooding and also significantly changed the seasonal pattern of flows. As a result of the growing cycles of the irrigation industries the time of peak demand for water is now late summer. As a result there are now fewer and smaller floods in spring and more floods in summer. Across the forest threats include altered hydrological conditions within wetlands, rising salinity levels, drainage water inflow, stock grazing, and timber harvesting.

**Water planning context**

Within the context of the Water Act 1989 the Victorian government white paper lays out the long term policy approach that will be taken to implementing sustainable management of the State’s streams. Under this process five regional Sustainable Water Strategies will be prepared including one for the northern rivers which will include the Goulburn Broken system. This plan is due for completion towards the end of the implementation of the Living Murray project due to be completed in 2009.

Future prospects are for continued population and economic expansion with consequent increasing pressure on water resources. Despite the difficulties that these factors will create there is a strong sense of optimism in the Goulburn Broken region. Looking to the future the 2003 catchment management strategy proposed that the ambition should be for:

- A catchment recognised locally, nationally and internationally for quality agricultural produce and where community values contribute to the benefits of abundant and well-maintained environmental assets used for tourism and recreational activities.
- The environmental footprint of irrigation and dryland farming will be significantly reduced with farmers occupying less land and using less water whilst managing their resources more sustainably. New opportunities will arise for increasing the ecosystem services provided by the land retired from agriculture and environmental flows.
- The region’s economy will be robust with much of the agricultural produce processed within the region generating employment and wealth creation opportunities for a regional community actively engaging in natural resource management programs.

Water management in the Goulburn Broken is both coordinated and divided. The Regional Catchment Strategy is a comprehensive program of investment to achieve a range of high level objectives which are supported by targets. It works, however, within a larger context which potentially makes its targets difficult to achieve. First there is the system of water allocations which is administered by Goulburn Broken Water. This determines the volumes of water available for production and the environment and to a large extent when that water will move through the river system.

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to meet the deliver requirements of Goulburn Broken Water and its customers. There is presumably some potential for the GBCM A to influence the timing and manner of the delivery of this water but it would be fairly limited given the priorities of the agricultural, horticultural and pastoral cycles.

In Victoria the Minister for Sustainability and the Environment has primary responsibility for matters relating to the definition of sustainable water management. Under the Water Act 1989 this includes continuous assessment of the condition of the States water resources and the determination of water allocations through bulk entitlements. As originally conceived and implemented these provisions were production focussed and treated the environment as a secondary consideration. The 2004 Victorian Government white paper *Securing our water Future together*, is the State’s long term water plan. Under the new plan there will be a formal review every 15 years to determine whether the resource base has declined, the causes, and the implications for users and the environment. Should adjustment be judged necessary as a result of this review the Minister has reserve powers to shift the balance between allocations to production and to the environment. Victoria does not at this stage have a formal process for developing holistic water management plans. Instead, for regulated rivers such as the Goulburn Broken system, the Minister allocates water for consumption and for the environment through the process used to determine bulk entitlements.

The new Victorian system divides entitlements into high and low components (high equating with the ‘entitlement’ and low the ‘sales water’ categories that existed under the previous system). Each irrigator has some of both but water in the low security category is only supplied when there is enough water in the storages to ensure supply of the high security water in the following year. The percentage of low security water entitlement that is actually supplied depends on the size of the surplus. Within systems that are judged over-allocated such as the Goulburn Broken the Environmental Water Reserve system will initially recognise all the existing entitlements and then be subsequently adjusted as part of the Living Murray project.

The relationship between the water management authority and the catchment management authority is mediated by their mutual connection with the Victorian government. The Victorian Government is in a position to alter the overall balance of water diverted for human consumption in its various direct and indirect forms (agriculture etc) but its decisions have to take into account the expectations of water entitlement holders who have strong rights that need to be respected. One of the ways in which it can shift the balance between the two components is by buying water for the environment and establishing trusts to manage it. In Victoria this is to be done through the creation of the Environmental Water Reserves. This leaves aside the more difficult problem caused by the disruption to the seasonal patterns of flow in response to the requirements of the various irrigation based industries which need most of their water in late summer early autumn a time of year when flows under pre European contact conditions were usually lowest. (Releases from the environmental Water Reserves will go some way to ameliorating that situation.)

The key point, however, is that the balance of water allocated for human uses and for the environment cannot be considered from a strictly biophysical point of view, social and environmental consideration must be taken into account. It is true that the
National Water initiative requires this triple bottom line approach but the convoluted and indirect way in which the elements come together in the Goulburn Broken catchment may not be optimal.

The second element of that wider context is that the GBCMA has only a limited range of levers that it can use to change environmental water management thinking and practice. The primary tool is money from the state government that it can use for investment. This is not usually used for straight commercial investments although that is needed in some situations as when for example it is decided to build a regulator to supply water to a wetland. The preferred avenue is to part-fund activities that resource managers or members of the community are willing to undertake if the costs are shared. Central to this approach is the need to build community support for the activities of the GBCMA. If the public shares its goals and people feel that their quality of life will be improved if they are achieved then they are likely to be interested in working as volunteers, through Landcare groups for example, on project where the GBCMA pays for the cost of material for example.

Implicit in this approach is the importance of social capital. In a region which there are many community and voluntary activities organisations such as the GBCMA are likely to get enthusiastic support. In other regions where social capital is low this approach is not likely to produce many results. It is not surprising therefore that the regional strategy for the Goulburn Broken region emphasizes the social strengths of the local community and that educational and consultative activities are a significant theme of its overall program.

A third element which conscribes the GBCMA is its relationship with a wide range of other public and not-for-profit bodies such as local government, environmental lobby groups, state and federal government agencies along with a plethora of relevant legislation and programs such as the MDB Salinity and Drainage Strategy and the Living Murray project. As the coordinating point for many policies and a source of information about the nature and condition of this very important catchment the GBCMA is in a position to influence what happens in those spheres. Conversely it is affected by the priorities of the organisations that it has to work with. This is very much an interactive process with many compromises required by all involved.

Goals

The goal of sustainable management is frequently stated as a high level principle but this needs to be transformed into more definable and quantifiably goals before it can be applied in practice. Somehow the social and economic dimensions need to be connected to the environmental in ways that will allow for a reasonable degree of consistency of judgement over time and between different options. A useful discussion which provides one example of how that can be done was conducted as part of the planning for the MDB’s Living Murray project. (The middle and lower sections of the Goulburn Broken sub-catchment and in particular the Barmah Forest are within the area for which that project was developed.) What was required was a decision support system that would allow consistent, repeatable and transparent comparisons between different biophysical scenarios so that governments and
communities could conduct an informed dialogue about the consequences of different levels of river modification.

In recent years a number of decision support systems have been developed to assist policy makers and managers. For the Living Murray project the eventual choice (with modifications) was a model known as the Environmental Flows Decisions Support System (EFDSS). Originally developed by CSIRO Land and Water it was regarded as particularly applicable to a lowland river floodplain system such as the Murray (and the middle and lower sections of the Gooburn Broken system). Within the EFDSS model were five sub-models for native fish habitat, floodplain vegetation habitat, wetland vegetation habitat, water bird habitat and algal growth. The structure of these models allowed for insertion of expert knowledge and data about a wide range of subjects. The native fish model, for example, is able to include detailed information about:

- flood spawners such golden and silver perch. They spawn and recruit during periods of floodplain inundation.
- Macquarie perch who require clean gravel beds. Floodplain inundation is not required but it is considered likely that they benefit from rising flows.
- Wetland specialists such as Australian smelt, bony herring Carp gudgeons etc which spawn and recruit in floodplain wetlands during periods when the flow is draining into the main channel.
- Freshwater catfish who spawn in course sediment beds under any flow conditions.
- Main channel specialists Murray cod, Trout cod, and river blackfish which spawn in the main channel during periods of flow in the main channel making use of woody debris.
- Low flow specialists such as crimson spotted rainbow fish and carp gudgeons which only spawn during low flow.

In addition to finding ways of including such data the designers of the decision support system need to define the relationships between the different elements in ways that can be processed by the computers that are used to run the model. These predicted relationships need to be tested and adjusted using information gained in the field or instream about what happens in practice under a wide range of conditions. This is needed to give confidence that the results from the computer modelling will have enough similarity to reality to be useful.

Although the regional catchment management strategy uses water flows as its defining principle it attempts to take account of a wide range of activities which interact with water to varying degrees. Given its broad environmental focus the strategy is for example concerned about the impact of built structures such as culverts, regulators and on-stream water storages. Many of these form major barriers to fish movement. It also attempts to take account of activities adjacent to streams that affect in-stream environmental conditions. Such structures which can include levee banks, raised roads etc also have social and economic impacts in that they change the behaviour of the river during floods. In many cases they increase stream velocities and create additional risk of flash flooding in the event of collapse. They also restrict the movement of water across the floodplain often leading to the isolation of wetlands.

and fragmentation of habitat. Increased flow caused by channelling can also increase erosion. Water trading is also resulting in new areas being irrigated which can also threaten habitat. The continuing growth of rural sub-divisions poses similar threats.

The GB Regional River health Strategy combines a number of elements of river management. These include programs that deal with water quality, flow, wetlands, instream and riparian flora and fauna, fisheries and recreation. The program has been worked out through a lengthy process of consultation with the community and interested groups. There are four objectives:

1. Enhance and protect the rivers that are of highest community value from any decline in condition;
2. Maintain the condition of ecologically healthy rivers (as defined by the Victorian River Health Strategy)
3. Achieve an ‘overall improvement’ in the recreational condition of the remainder of the rivers
4. Preventing damage from inappropriate development and activities

The requirement to at very least stabilise the biophysical condition is a strong feature of this list as is also the importance of taking account of community expectations in terms of the appropriate balance between social, economic and environmental considerations. A category described as ‘heritage rivers’ was ranked highest in relation to ‘highest community value’. Taking the 430 km Goulburn River as an example characteristics which caused it to be given that category included high quality environmental conditions in many reaches, the quality of its native fish habitat and recreational fishing and canoeing opportunities, cultural heritage sites and scenic landscapes.

Remedial activities are subject to assessment using the Index of Stream Condition (ISC) established by the Victorian River Health Strategy which provides the overall framework for the 10 catchment management authorities in Victoria. The ISC system provides a numerically expressed score that is used for target setting and comparisons between options. The ISC measure the degree of change from pre-European contact conditions using five ‘stream health’ criteria:

- Hydrology which relates to volume and seasonal pattern of flow
- Physical form – channel stability, degree of degradation, influence of artificial barriers, absence or presence of debris
- Streamside zone – plant species native/exotic, extent, environmental continuity, links
- Water quality – levels of phosphorous, salinity, turbidity
- Aquatic life – abundance and range of species of macro invertebrates.

For each stream reach, the major streams are divided into precisely defined sections. The ISC score for each of these items then provides a benchmark against which to measure more recent change. For example the Goulburn Broken River Health Strategy is aiming for a 65 percent reduction of phosphorous below 1996 levels and has numerical ISC targets for all major streams.

Policy development and management for the Barmah forest is not fundamentally different to that undertaken for other parts of the catchment but rather at the top end of

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90 Goulburn Broken Catchment Management Authority, 2005, p1.
the scale with some extra features. There is still the need for community support as with most integrated catchment management programs but for this area an extra dimension has been added through the operation of the Barmah Millewa Forum which places consultation at a much higher level of continuity and intensity. There has also been additional effort to deal with the impact of the altered hydrological cycle by arranging for a special allocation of 100 GL a year to be made through the Murray-Darling Basin Ministerial Council. This has been complemented by the construction of regulators at key points so that the sections of the forest can be watered and dried out at times that are more environmentally appropriate and frequent than would be the case under the usual pattern of river operation. In parallel there is a much higher level of monitoring and additional investment in research to investigate key biophysical processes so that more targeted management programs can be developed.

**Convoluted process**

At the core of the Victorian approach is the role of the minister exercising discretion. Throughout the white paper is a continual stress on the need to respect the integrity of entitlements to the point where that appears to be the de facto priority. Although an impressive list of remedial activities are planned there does not appear to be any clear process for defining sustainability goals and monitoring whether or not they are achieved. It is hard to assess where Victoria stands on the requirement of the NWI to prioritise the achievement of sustainable water management. On the one hand strategies such as the Goulburn Broken River Health Strategy through its use of the ISC assessment system seem to be based on the requirement to achieve environmental stability at the system level rather than the combination of rather symbolic remedial projects within a situation of ongoing decline which has been the norm for much hydrological system management in the past. If the management system is being redesigned to achieve system stability at a socially acceptable level of modification it would appear compliant with the NWI. A worrying feature of the Victorian system, however, is that it does not appear to make that goal mandatory.

The treatment of the possible impact of climate change is indicative of vagueness at the core of the Victorian approach. The white paper cites the example of a 20 percent reduction in inflows into Goulburn Broken storages. Under the existing system modelling indicates this would cause the environment’s share of the total to drop from 43 to 37 percent. The white paper then discusses the process now used for calculating the proportions going to production and human consumption on the one hand and the environment on the other and speculates that it could be adjusted ‘so that the environment automatically has the same proportion of total resource, without the need to make periodic adjustments’91. This statement raises a number of problems. Under paragraph 48 of the National Water Initiative all of the reduction caused by climate change should come from production and human consumption and none from the environment. Alternatively, it may be that some compromise could be worked that reduced the impact on production but was still compatible with the maintenance of environmental stability. However the white paper does not raise that possibility.

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Second Case Study - Daly River Northern Territory

The hydrological systems of northern Australia are currently part of the national debate about the future of water management in Australia. In January 2007 the Prime Minister John Howard in an address to the National Press Club, presented a plan for water security which among many other things included a task force to examine the potential for future land and water development in northern Australia. As part of that process the task force is to identify key eco systems, the assets important to the wide range of stakeholders involved with the region and the water requirements for future sustainability. Submissions will be sought from both industry and community groups. The task force will report its findings in 2012. It will have a $20 million budget will start work immediately.

A central focus for this debate in the Northern Territory is the Daly River catchment just south of Darwin. Even before the Prime Minister’s announcement the future of the region was the subject of long debate and many rumours. These include the prospect of huge bio-fuel projects although details about such proposals are hard to find. For a number of years the Daly River has been seen as one of the areas with the best potential for irrigation in the North having water all year and patches of relatively good soil. It is these areas that are being targeted by proposals for irrigation. Approximately 200,000 hectares of land or about 4 percent of the total has been cleared in the catchment and another 110,000 has been identified as suitable for future clearing. At this stage, however, the Daly catchment is largely free of dams, weirs and other such structures.

Climate is characterised by wet monsoonal summers and dry winters with most of the rain falling in the months November to April. The average fall over much of the catchment is over 1000 mm. The climatic cycle is very predictable but the length, intensity and occurrence during the period during which a given pattern is expected is highly variable. Overlaying this annual pattern are longer term cycles of high and low rainfall with recent decades apparently part of a wet phase. Vegetation ranges from eucalypt forest to low open savannah. Beef grazing is currently the dominant land use but irrigation is growing in importance, in particular on one of its tributaries the Katherine river. The catchment includes the town of Katherine, the fourth largest in the NT, Pine Creek and Nauiyu an indigenous community. There are at least 10 Indigenous language groups who make up about 25% of the population and manage about 30% of the area. The region is dominated by savannah woodlands.

In the lead up to 2003, NT government plans to clear and develop the region generated considerable controversy. During the dry season the Daly is one of the few rivers with flow. This is derived from groundwater systems that also underpin many wetlands throughout the region. Its dry season flow is about five times that of any other river in the Northern Territory with total flow to the sea averaging over 6000 gigalitres per annum. Three large limestone aquifers feed the Daly River during the dry season. In the upper catchment these feed many hundreds of springs and seepage areas over a widespread area. Although limestone aquifers also support other rivers such as the Roper they do not generate comparable volumes of flow. The Daly system does not have large potential dam sites and any expansion of irrigation would need to be based on withdrawals from groundwater systems or direct from the river itself.
Environmental issues

Calcium and magnesium salts derived from the limestone aquifers, rather than the more usual sodium and chloride salts, and very low levels of phosphorous and nitrogen give the river unusual characteristics which have had a distinctive influence on the flora and fauna. They also make the river highly sensitive to the impact of fertilizers and other agricultural chemicals carried into the hydrological system by erosion and overland flow. Its very clear waters are also threatened by agricultural and pastoral activities that could cause increased sedimentation. The high levels of water clarity support the growth of plants such as Vallisneria nana a key food source for pig-nosed turtles. The very low levels of nutrients in the Daly River also limits the growth of algae and higher aquatic plants which in turn reduces the numbers of predators. If increased nutrient due to agricultural activity was combined with reduced flow due to irrigation diversions this would favour introduced species over native plants and have significant impacts further up the food chain.

The river itself supports many rare and endangered species including the pig-nosed turtle a highly significant species to local indigenous communities which is found in only a few rivers in Australia and Papua New Guinea. The best Australian populations of the pig-nose turtle are found in the Daly River. The range of turtle species in the river is also the largest for any river in Australia (eight out of 12). The Daly River is also of high conservation value in terms of its fish species. Supposedly the best barramundi fishing river in Australia, the river is home to 48 fresh or estuarine species which includes a number that are rare or endangered such as the freshwater swordfish and whiprays. While the volumes of water that flow through the system are important perhaps even more significant is the continued maintenance of the environmental characteristics including those related to habitat. Water depth, temperature, shade along banks, the nature of organic material entering water bodies all play an important part in the ecological system.

More than 350,000 hectares of wetlands are present in the Daly catchment in many cases maintained through the dry season by continuing seepage from the groundwater systems that are replenished each wet season. The middle reaches of the river are listed on the Registrar of the National Estate and the lower floodplain and estuary have been assessed as meeting the criteria required for registration as Ramsar wetlands. Its complex of wetlands is one of the most significant in the Northern Territory. A total of 45 waterbirds have been recorded in the region and the Daly wetlands support some of the largest breeding colonies of colonial nesting waterbirds in the Northern territory.

The situation of the pig nosed turtle is of particular concern. It is the last remaining species of a family which has existed for 40 million years. From an environmental perspective considerable attention has been devoted to investigation of its needs. It has been described as an umbrella species in that success in dealing with its needs is likely to lead to the preservation of a number of other species whose biological, ecological and environmental requirements are less stringent. The pig-nosed turtle’s vulnerability is in part caused by its nutritional dependence on a single food source the plant Vallisneria nana and its unusual breeding process. The favoured nest sites are fine sand banks adjoining water in the middle and lower reaches of the Daly system. The turtles rely on warm water discharged from springs to keep warm. During
reproduction the females rarely move from these places. The sex of young turtles is determined by the temperature of the water within which they hatch. If water levels are reduced due to water extraction for irrigation, nests may dry out earlier and become hotter thereby reducing the percentage of males which only hatch in cooler nests.

Community stakeholders

The assets of the Daly Catchment support a range of human stakeholders ranging from recreational fishing and tourism to a growing irrigation industry. Much of the irrigation upstream in the Katherine area draws from the groundwater systems that also serve the Katherine/Daly River. The Daly supports a wide range of flora and fauna many of them of great cultural significance for indigenous people in the region. There are also many sacred sites that depend on the maintenance of adequate flows. Loss of flows would not only expose these sites visually but leave them open to erosion and vandalism. Catchment planning is seen as the key to resolving the competing tensions. In late 2003 the NT government declared a moratorium to allow a process of community consultation. Despite considerable community dissatisfaction with the process a report was delivered but shelved. The moratorium was then extended to 2007 and an alternative planning process developed with a community advisory group advising the minister but not playing a central role.

The National Water Initiative recognises the importance of indigenous issues in terms that give them a high priority but which are frustratingly vague. Development of the Daly River catchment water plan provides an excellent opportunity to work through some of the intractable issues involved in attempting to appropriately recognise Indigenous interests according to these principles. Recognition of indigenous interests in water is of particular importance for the Northern Territory given that much it is now managed by Indigenous people an increasingly significant political force given the continuing expansion of their population. In the Northern Territory approximately 85 percent of the coastline and about 50 percent of the land mass is held under Aboriginal title. Increasingly river ecosystems in Australia are being recognised as legitimate ‘users’ in their own right but there has been less success with efforts to give similar recognition to indigenous interests.

Indigenous interests are a complex mix of cultural and economic the latter term covering everything from eco tourism to irrigated agriculture. The traditional economy is also important with hunting and fishing both being of real material significance for many indigenous people. Sue Jackson from CSIRO Sustainable Ecosystems has argued that Indigenous interests do not translate easily into Western environmental management frameworks which are focussed on objectification and quantification. The concept of environmental flows especially when costed in monetary terms is an example of this tendency to define everything in quantifiable units so that they will be easy to compare and manipulate within a standard management framework.

Drawing on a large body of research Jackson has described a relationship between water and indigenous people which is much more complex than that of European settlers in the region. In the latter case the cultural dimension is a fairly defuse and often poorly articulated aesthetic and emotional response that tends to be secondary to
the focus on economic goals encouraged by the cultural stress on the benefits of defining relationships in monetary terms. The Indigenous connection is much more complex and can only be reduced to monetary western management terms with great loss of cultural richness. For example the distinction between water and land, while a standard device within western systems of biophysical analysis is fundamentally alien to the indigenous conception of country.

Western systems give priority to land as measured and allocated to particular owners as the basic unit for natural resource management most of the time. Developing a similar approach for water has proved difficult. This is reflected in the debate in western societies, evident in the various controversies related to implementation of the National Water Initiative, caused by the need to define and manage water, an inherently changeable substance, in ways that can be incorporated into a traditional property framework. Jackson and others have argued that this is one reason why there has been greater recognition of Indigenous relations with land rather than with water and the wider ecological system. This, arguably, disproportionate emphasis on land rather than the environment as a whole has led to a serious underestimation of the importance of water to indigenous people. Consequently efforts to separate land and water property rights, a major theme of recent proposals for clearer water entitlements and increased water trading, create serious problems in areas where Indigenous interests need to be taken into account.

Partly in response to the confusion that exists about how to best respond to Indigenous interests in water there has been a tendency to use environmental flows as a surrogate, presumably on the indefensible grounds that both are seen as wild, not production focussed and ‘natural’. While Jackson and others concede a substantial overlap they envisage situations where a flow regime determined according to ecological values would not meet cultural needs. In practice, however, there is very little guidance available for determining questions such as ‘how much water does culture need?’

In the past this could have served as a reason why Indigenous interests would have been marginalised but that possibility in the Daly River context ignores the larger political context. If the negotiations about the future development of the Daly system do not result in a negotiated solution that satisfies most of the indigenous community in the region the result will be political instability and a most uncertain investment environment for investors in irrigation projects. This creates pressure that has rarely been present in the past for the wider society to take substantial account of indigenous concerns.

In the past the lack of natural resource management institutions that could relate easily to those of government and business was one of the many reasons why indigenous interests were ignored. While still a large problem this growth of the Land Councils system has begun to remedy that lack. In particular the Caring for Country Initiative developed by the Northern Land Council has played an important role developing catchment management skills. As of August 2005 there were over 30 ranger groups employing over 350 people.

The development of planning for the Daly will also have to take account of the way in which indigenous people are scattered throughout the region in small communities rather than being concentrated in a few large centres as is the case with non-
indigenous people. This is the result of their relationship to place, water as well as land, and means that they will be physically present and adjoining those development projects which eventuate. Physical propinquity could be a major factor shaping the political dynamics of irrigation development in the Daly River region.

Discussion about Indigenous cultural priorities should not obscure the fact that many members of Indigenous cultural communities want water for the same economic activities as do non-Indigenous groups. However, Sue Jackson argues that in some cases at least the prime motivation for Indigenous efforts to take part in new irrigation projects is to maintain an on-going relationship with country (land and water) rather than just the prospect of economic gain. This leads to the conclusion that the relationship between indigenous people and water should be seen as evolving rather than something which is fixed long term. In turn that suggests that the institutional processes used for water planning in the Daly region will need to be highly robust and able to integrate a wide range of demands and pressures.

Range of values

The Daly River is not only important for irrigation and human consumption. An outstanding characteristic of the social and economic values associated with the Daly River is that many of them do not lend themselves to expression in economic terms. Important values include environmental and aesthetic values along with those that apply to bequests to future generations and the preservation of options. Typically such values do not involve ‘use’ of water in the sense of activity that diminishes the volume of water. There are other values that do or could have an economic dimension such as the use of water for tourism or recreation, which also do not involve diminishing the volume.

In recent years pressures on the Daly system have grown significantly and will almost certainly increase much more. In some cases the different values systems are complementary and not in competition. This includes some environmental, aesthetic, indigenous and recreation values such as those involved in recreational fishing which is a major activity on the Daly River. There are points of conflict, however. These include intensive agricultural processes which can not only involve water extraction but also the creation of structures such as fences which block access to the river and land clearing which can increase soil erosion and the passage of silt and chemicals into water bodies. Tourism is another category which in addition to increasing water use for consumption by visitors also generates changes to the land and riverscape that can have visual and audible impacts which cause conflicts (power boats etc).

Commercial fishing is also a significant issue. Although it shares the aim of maintaining the river system as a high quality environment it can generate conflict with irrigated agriculture and recreational fishers. There is also conflict caused by the efforts to preserve particular areas for reasons related to Indigenous cultural values. At this stage, despite proposals for major development the Daly river is still largely a pristine river system with very high values from indigenous, environmental, tourism and recreational perspectives and there is likely to be strong political pressure to maintain it in that condition.
In recent years there has been a focus on developing market mechanisms to provide a meeting point for competing demands. However, it is difficult to develop market processes that will allow easy tradeoffs between economic activities that use or reduce the volume of available water and those that don’t, let alone with non-economic activities conducted by people who not only do not consume or reduce the available resource but who have political power even though they lack economic power. Indigenous interests are only one example in this category. Determining water prices is going to be difficult for this range of uses. Although many uses don’t diminish the volume of water there are real financial costs associated with recreational fishing or tourism for example. Defining a process and defining a point where costs could be imposed will be difficult. It is likely that non-market process and institutions may be needed for this situation.

History or research and settlement efforts

Water management in the Daly River region brings together most of the major themes that have dominated the national debate about the future of northern Australia since soon after the beginning of European settlement in the late eighteenth century. Alternatively seen as the gateway to Asia or as a protective barrier that can be used to keep the people of that vast region at bay, northern Australia has long been a source of frustration for southern planners. Key to many of these plans has been the Daly river region with its patches of relatively fertile land adjoining one of the few rivers that flow throughout the year. In terms of agricultural development, however, even this region has been the scene of a long succession of failures. In the past its farming projects have rarely been better than barely profitable usually with a very heavy dependence on low paid Indigenous labour subsidised by the government welfare system.

This public subsidy of the labour system is just one example of what has been and is a pervasive feature of European settlement projects in the north. Bruce Davidson’s book *The Northern Myth* published in 1965 was one of a number of studies that have revealed the poor quality economic and strategic analysis that has underpinned many development projects in the region. Libby Robins recent book *How a Continent Created a Nation* describes a long history of efforts to find the formula to developing the north. In particular this has involved the CSIRO and the Australian National University’s North Australia Research Unit (NARU) and more recently Land and Water Australia, all national organisations established in part to deal with exactly this type of development issue. In 1977 a seminar titled *Cropping north Australia* concluded that so far it had been a history of ‘trial and (mostly) error’. Another characteristic of the past has been refusal to pay much attention to earlier mistakes a practice which the anthropologist Bill Stanner noted was already well established by the 1930s. Contemporary efforts to chart the direction of future development are attempting to build on that very mixed legacy.

The new wave of development now well under way is meant to be based on different imperatives and much better science than in the past. The focus at least initially is the local regional economy rather than distant export markets. Planning is now attempting to take account of the interests, skills and culture of the local community particularly the indigenous community. Concern for environmental issues is also strong and there is a strong desire to avoid the mistakes that have degraded the Murray-Darling Basin.
Land and Water Australia’s *Tropical rivers R&D program* is an example of the current approach. Developed in anticipation of increasing development pressure it is a determined attempt to get a balance of social, environmental and economic interests as required by the National Water Initiative. In the context of the relatively pristine conditions of northern Australia it aims for a balance of national development priorities and regional aspirations; in this case the latter is more restrained than the former.

**Water planning**

The Daly River is declared as a Water Control District under the Northern Territory 2004 Water Act which is administered by the Controller of Water Resources on behalf of the Minister the ultimate authority. The water act is supposed to cover all aspects of sustainable water resource management, including investigation, use, control, protection and allocation. As with all areas that are declared Water Control Districts a water allocation plan has to be prepared. For the Daly River the water allocation plan is to be prepared for release sometime in 2007. An earlier attempt to prepare such a plan which involved fairly wide consultation but in a very short time frame and with vaguely defined terms of references failed. The second effort has a tightly controlled consultation process and the preparation of the plan is being undertaken within the relevant government department.

Under the Northern Territory Water Act the requirements of all groundwater dependent systems must be maintained and total ground water extraction must not exceed 20 percent of annual recharge, with at least 80 percent retained for environmental use. At least 80 percent of flow at any time is allocated to the environment. This means that during the long dry season the flow in the Daly River cannot be depleted by more than 20 percent at any time compared with what the flow would have been if no diversions were taking place. Or to state the proposition another way it is not permissible to pump the Daly River harder than at the 20 percent rate at any time in the dry season in order to extract 20 percent of the estimated total recharge that went to groundwater during the wet season.

Many debates about what is an appropriate level of extractions in a given situation assume that the damage done increases as the level of extraction increases. In the case of the Daly catchment this may not be the case. The volumes of water stored in the groundwater systems are apparently large but it seems possible that very dramatic negative environmental impacts could result from a fairly small level of extractions. If those extractions are sufficient to cause groundwater systems to be no longer in contact with low lying sections of the undulating landscape, even though a high percentage of the total groundwater resource still remains, then the wetlands, springs and swamps that are created by seepage will not receive water during the long dry season with potentially devastating consequences.

The Water Act provides a framework to deal with a range of issues which include surface and groundwater management, water quality and water resource development. This includes penalties for a range of offences such as causing pollution. In the opinion of an assessment of the Act prepared by the Environmental Defenders Office (NSW) for the NT government, compared with other states penalties are low. In addition there does not appear to be any formal requirement for consultation with
other departments of agencies involved in related activities or coordination with other natural resource plans.

In assessing the compliance of the NT legislation with the 1994 CoAG reform program and the NWI the New South Wales Environmental Defenders Office concluded that:

‘There appears to be considerable reliance by both the Northern territory Government and the bodies that have reviewed performance under CoAG and the NWI on the fact that the NT’s resources are what those bodies term ‘underdeveloped’. In our opinion, a better description of the territory’s water resources is that they currently retain significant natural values. The result of this reliance is that the rigorous investigation and modelling that is being used by other States to determine sustainable yield or flows required for environmental purposes has not been carried out with the same level of detail in the Territory.’

The EDO analysis, which has particular significance for the Daly River the prime area for potential future irrigation development in the Northern Territory, argues that a fundamentally different approach should be taken to the process of defining environmental sustainability compared with the approach used for the highly modified rivers of southern Australia. Rather than attempting to find a level of modification acceptable to the main stakeholder groups involved, the authors argued, the emphasis should be on making sure that the level of extractions and other influences resulting from development should not be allowed to damage the integrity of the original values given their rarity and value. These issues are unresolved at this stage. Under the existing water management system decisions about them will be the responsibility of the Northern Territory and Commonwealth ministers bargaining with each other and exercising their discretionary powers.

Looking at the way in which water planning is conducted in the Northern Territory the EDO recommended that:

- Legislation governing the use of water resources should include a clear statement of the purpose of or objects of the Act, which should provide for the importance of sustainable water management and ecological protection and should give top priority to the use of water for the protection of the health of aquatic ecosystems.
- Such legislation should require the decision makers to act in accordance with the objectives of the Act.
- Water planning legislation should include the use of the best scientific evidence, the use of expert panels where appropriate, and provide for community consultation and rights of appeal.
- Legislation governing water management planning should include clear, mandatory requirements for creating plans and directions about the contents of plans and the range of types of plans.
- Water management plans should be considered in light of other natural resource initiatives and should be drafted in a way that is compatible and consistent with other planning instruments.

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- The Minister or Controller should be required to regularly report to the public on the effectiveness of water management plans in achieving their objectives.
- There should be different categories of licenses for water extraction, which should reflect different purposes and provide a hierarchy of levels of security.
- The process for granting licenses should include mandatory consideration of relevant factors specified in the legislation, consideration of whether a person is a fit and proper person to hold such a license, a process of public consultation and the opportunity for an objector to appeal.
- Water trading should be permitted only where it promotes the maintenance of improvement of the existing condition of the resource.
- Public registers of licenses for water extraction and water trading should be maintained.
- The process for granting approval of water use or works should include mandatory consideration of relevant factors specified in the legislation, a process of public consultation and an opportunity for an objector to appeal.
- Offences against provisions in the legislation should provide for penalties that act as significant deterrents and should include innovative penalties for breaches of water trading or water license conditions.
- Wild rivers should be given special protection in recognition of their high conservation significance\(^\text{93}\)

\(^{93}\) Environmental Defenders Office New South Wales, 2005 May, p4.
Third Case Study - The South Australian Murray-Darling Basin

In the MDB the three upriver States each have a section of the top part of the basin (Victoria in the south, New South Wales in the east and Queensland in the north). Water flows from those States into South Australia with the bulk of flows coming from Victoria and New South Wales. As a result riverine conditions in South Australia reflect the cumulative impacts of activities in all three top basin States as well as in the State itself. This means that compared with its neighbours, South Australia the end-of-system State, is potentially more exposed to the cumulative impacts of growing development pressure, much of it in areas controlled by other jurisdictions. The National Water Initiative requires a whole-of-system approach to water management. There is no State in the MDB in a less favourable position than South Australia to deliver that result. Despite this it has made a substantial attempt to develop such an approach to the degree that it is able.

The South Australian section of the Murray-Darling Basin constitutes only 7 percent of that State but is one of its most productive regions. The population of the region is just over 80,000 people and its economy is heavily dependent on agriculture with much of it related to use of water from the river. In terms of income fruit including grapes is the most valuable commodity produced in the catchment. The total value of irrigated agriculture in the region is estimated to be over $500 million per annum. This in turn supports much of the manufacturing and many other economic activities. Commercial fishing, recreation (including fishing) and tourism are also significant.

The River Murray catchment within South Australia encompasses a wide range of environments. To the south and east stretch the dry mallee plains while to the west of the lower reaches are the Mt Lofty Ranges. These areas contain unique landscapes. The Coorong and lower Lakes and the Riverland, for example, have been placed on the Ramsar Register of wetlands of international importance. Despite their importance and status, however, these are also seriously degraded and contain many now rare, vulnerable and threatened species of both flora and fauna. This degradation is largely the product of human activity. Altered flow regimes, reduced water quality, introduced pest species and habitat modification and loss are the main causes.

As a result of the growth of diversions over the last few decades much less water now crosses the border and peaks and troughs in the flow come at different times and for different lengths of time compared with the past. In recent years, but before the drought, flows out of the Murray Mouth averaged about 28 percent of pre development levels. Over the last few years there has been very little flow through the mouth apart from tidal movement and even that has only been made possible by regular dredging. The Murray-Darling Basin Agreement gives South Australia an entitlement of 1850 GL at the border under normal climatic conditions and a third share of the available pool in Hume Dam during times of severe drought such as the current period. Of this some 850 GL is used by agriculture and for human consumption. About 95 percent of the State’s population receives some of their water from the River Murray. This provides greater certainty of supply for centres which would otherwise be more marginal for settlement and development because of the lack of an assured water source. Adelaide receives about 40 percent of its water from
the Murray in an average year. During drought that proportion has sometimes increased up to 90 percent.

Declining water quality or the threat of it, has been a serious issue in recent decades. The causes are increasing salinity and nutrient content as a result of upstream agricultural activity and greater turbidity as a result of the fact that much of the water now supplied to South Australia comes from the River Darling. These changes create difficult conditions for native fish which evolved under a different environment and make the river much more attractive to introduced pest fish species such as European carp. Habitat has been altered by a wide range of practices. This includes snag clearing of logs that provide fish habitat, erosion which has filled up the deep water holes, and the placement of a series of weirs that have created long stable weir pools and lifted groundwater levels in the surrounding regions. Near the Murray Mouth severe changes have been imposed by the construction of the barrages which now separate the fresh lower lakes from the Coorong. The area immediately around the Murray Mouth is now hyper saline. Before the impact of European settlement, this was a large estuary, rich in fish and home to vast numbers of birds.

Despite all these factors there is still a high diversity of biota in the South Australian section of the river murray. There are 340 species of vertebrates, including 219 bird, 25 mammal, 7 frog and 28 fish species in the Chowilla wetlands alone. The Chowilla wetlands are just upstream of Renmark. Just under 18,000 hectares in extent, it is one of the few parts of the lower Murray floodplain that has not been used for irrigation. Its attributes and its problems make it emblematic of the challenges facing river management throughout the MDB. More than 100 kilometres of anabranch creeks thread through the Chowilla floodplain making this one of South Australia’s most important recreational areas. It is estimated that Chowilla supports about 15 percent of the native fish stocks of the state and many threatened species of vegetation.

But the Chowilla floodplain is a difficult area to manage. Between 50 and 100 million tones of salt is thought to be stored in the groundwater below the floodplain and about 43 tonnes of salt a day drains into the River Murray under normal low flow conditions. After flooding, however, the water retreating from the floodplain can carry up to 1700 tonnes of salt a day back into the river a phenomenon that can cause severe damage to the environment and irrigation downstream. A striking feature of the Chowilla area is the State’s largest red gum forest although the combination of the current drought and increasing diversions upstream appears to have killed off a large proportion of the trees in the last few years. The declining condition of the Chowilla floodplain is striking evidence of the failure of river management in the MDB to contain development pressure despite strong commitments to do so since the mid 1990s.

Institutional context for water planning

In 2001 the South Australian parliament conducted a far ranging review of the institutional arrangements in the MDB and in South Australia itself. Among many other things its report recommended that the State adopt the Integrated Catchment Management Policy Statement just approved by the MDB Ministerial Council. At the basin-wide level the ICM policy statement was rapidly marginalized but South Australia has moved systematically in recent years to incorporate its principles into
policy and management practice within the State. This process has included legislation to expand the responsibilities of the River Murray Catchment Management Board to include all resource management activities related to water such as soil conservation, native vegetation management and animal and plant control. The Board has also been given an independent funding source through the establishment of a catchment levy applying to all residents within the South Australian section of the MDB.

Reform has been implemented progressively. A major step was the Natural Resources Management Act 2004 which provides the legislative framework. More recently, under that 2004 Act, a regional Natural Resources Management Plan is being prepared for the South Australian Murray-Darling Basin. It will be cover a ten year span and include a three year business plan that will be subject to progressive revision. The planning document stress however that although it will be a ten year plan the perspective for many issues will be forty to fifty years. The plan is to be prepared in time for implementation in July 2009.

In response to the difficult situation of the State, vulnerable as it is to developments upstream, a relatively thorough whole-of-system approach is being taken. According to the State Natural Resources Management Plan the landscape scale will address issues at the terrestrial, freshwater, marine and coastal ecosystem functions at the bioregional level, the productivity capacity of land at the land systems level and water resources at the catchment level (to the extent that is possible given the State border). The new plan will bring together a range of plans that have previously operated fairly autonomously. It is being developed with an appropriate recognition of the larger context. At the national level there is a range of policies such as the National Water Initiative and the Australian Government Bilateral Agreements with South Australia for National NRM Programs. At State level there is the State NRM Plan.

The plan will be comprehensive and include water allocation planning, environmental water management and natural resources management. Major natural resource assets will be catalogued along with their condition. There will also be an assessment of environmental trends and of threats to the natural resources assets. Long term targets will be set and sustainability limits will be defined. Other activities include an analysis of community capacity, identification of institutional reforms that will be needed, and also risks and barriers to implementation.

Central to the process of developing the plan will be an extensive consultation process. Components will include futures forums, interactive web based activities, workshops, public meetings, a wide range of media activity, the production of issues papers, surveys and much more. Unlike the technocratic style of water management that was accepted procedure until two or three decades ago contemporary water management depends on a high level of active community support and involvement not least because there is a strong reluctance to use regulatory methods in any but extreme cases. Winning the battle for the hearts and minds is crucial for success.

Community education and involvement is central for the implementation of water planning. The new plan will build on an already well established program. The goal of the existing program is to ‘raise awareness in the catchment community of the need for and benefits of improved land and water management that leads to behaviour
change. It is a program with ambitious targets. There are to be broad based educational strategies, activities to promote direct community involvement and targeted education strategies. Awareness is to be raised by 15 percent. The important role of youth is recognized through the establishment of youth councils in order to increase their involvement. Links are to be strengthened with schools and efforts made to include relevant material in school curriculums. A local government education and training strategy is to be developed and the number of schools and communities in the region actively involved is to be lifted to at least 50. Related to these programs are efforts to take account of the interests of Indigenous people and increase their degree of participation.

Development and implementation of water plans depends heavily on voluntary support by the community. An example of how this can work in practice is the Angas Bremer Water Management Committee (ABWMC) a publicly elected group in the Langhourne Creek district adjoining Lake Alexandrina. In 2001 they developed and implemented the Angas Bremer Code of practice which required the district’s irrigators to monitor irrigation efficiency and groundwater levels and plant two hectares of deep rooted perennial vegetation for every 100 megalitre (ML) of water allocated to reduce drainage effects. The code of practice is linked to a statutory water management plan prepared under the aegis of the River Murray Catchment Management Board. Compared with data for the year 1981 the group has reduced total water used from 7.8 to 2.6 megalitres in 2001. This success story brings together community cooperation, technical innovation and a judicious component of external auditing and regulation.

The community has been actively involved in environmental remediation for over twenty years in response to highly variable groundwater tables underlying the vineyards of the area. By the time the district was proclaimed as a groundwater management area in 1981, extraction was taking place at about four times the recharge rate from the Angus and Bremer rivers. As a consequence there was a growing risk that saline groundwater would be drawn into the aquifer.

Since 1981, however, groundwater usage has been reduced to about equal of recharge and returns to vineyard operators have gone up. This was the result of a number of changes which included a 30 percent reduction in groundwater entitlements, a switch in grape crops to less water demanding wine varieties and the construction of a locally financed system of pipes to bring water from the nearby Lake Alexandrina. As a result of the introduction of the 1997 Water Resources Act the previous statutory powers of the local committee were transferred to the then River Murray Catchment Water Management Board. (RMCWMB) In response to the new circumstances the ABWMC elected a committee and lobbied for continued involvement with local policy and management. A partnership was arranged with the RMWCMB and the ABWMC then took over responsibility for developing the local Water Allocation Plan. In recent times membership of the ABWMC has included both local irrigators and technical staff from relevant agencies, a combination that is a successful blend of local knowledge and technical perspectives. One result was the highly effective Angas Bremer Code of practice for Irrigators.

Research has indicated that the greatest risk to the district is from high water tables during times of irrigation with water from the Lake. This has been controlled by a
system developed by the CSIRO which gives warning at the same time that the process is happening when rising groundwater reach dangerous levels. This allows irrigators to stop adding water immediately. The requirement that all irrigators grow two hectares of perennial vegetation for every 100 megalitres they apply in order to increase transpiration has also been very effective. A recent conference paper prepared by people from the area surmised that uptake would have been much less extensive if this scheme had been imposed by government regulation rather than community agreement and peer pressure.

The auditing system in place in the Angus Bremer catchment is a good example of how self-regulation and external regulatory systems can be combined. Irrigators submit annual reports which are then audited by the ABWMC. The combined audit report for the district and a list of those irrigators who did not meet the standards required by the code of practice is then sent to the minister. Subsequently, agency staff provide advice as to how the irrigators concerned can comply so that in the following year they will achieve accreditation. The pressure that this process generates is then complemented by random audits of about 10 percent of those who were reported as successful by agency staff. This combination of community and regulatory agency effort has been judged as highly effective and is being extended throughout the South Australian Murray-Darling Basin region.

**Impact on South Australia of the lack of basin wide management**

Implicit in the NWI’s whole-of-system philosophy is integrated catchment management. This approach promotes the management of water in ways that take account of its relationships with the many other factors which affect it and are affected by it. Within South Australia there has been a progressive movement towards more integrated catchment management. This has also included significant institutional development based on a conscious effort to take account of the particular nature of the environmental issues that have to be managed.

South Australia’s movement in this direction has been significantly stifled, however, by the lack of progress with the same issues at the Basin-wide level. The debate within the MDB Ministerial Council and MDB Commission has been similar and reached similar conclusions to that within South Australia but it has not yet resulted in the institutional changes across the MDB as a whole that would allow integrated catchment management to be incorporated into management practice. (That may be about to change with all governments agreeing in early 2007 on the need for substantial reforms - although Victoria is still resisting the specific proposals being put forward by the Commonwealth at this stage).

The reform paralysis that beset the Ministerial Council and Commission in recent years had a number of causes and manifestations. The Ministerial Council is excluded from considering many important biophysical processes that are reshaping the MDB in negative ways by the operation of the potential veto available to each member that is created by the requirement that all decisions be unanimous. Representation on the Council and Commission is exclusively jurisdictional (as opposed to skills based) and in recent years this has resulted in highly defensive behaviour by the members of both groups. There is no corporate requirement binding on the members of the council and commission to work for the good of the MDB as a whole rather than the narrow
interests of their particular government. In addition, in recent years the Council and Commission have retreated from a whole-of-catchment focus despite the widespread consensus that such a perspective is needed to maximise the benefits and avoid the high costs that come from beggar-your-neighbour behaviour. This is reflected in both the uncooperative approach often taken to cross-border issues and also in the pulling back from policy development for those parts of the catchment beyond the main river corridor of the River Murray.

The Living Murray project, which is meant to delivery substantial volumes to six icon sites along the Murray, is being implemented in a context of very poor data. This makes it difficult to be confident that environmental gains in one part of the system are not eroded by expanded water use elsewhere. The many and various processes and devices that are used to monitor water movement in the irrigation regions of the MDB developed at a time of expansion when the priority was to distribute as much water as possible from the newly built storages. Those arrangements were not designed to control and measure allocations except in times of drought but rather to promote use and development. The priority now is different. Finely calculated allocations to competing uses have to be made. Water trading is one of the main mechanisms being used to do this. That requires the technical and administrative capacity to accurately reduce allocations in some places and increase them in others to reflect transactions. Water distributions systems worked fairly well under the earlier priorities when the overall demand pressure on water bodies was considerably less than now. In many regions, however, it is proving difficult to increase the levels of efficiency of monitoring and management to the standards now required under these new circumstances.

A report prepared for the MDB Ministerial Council by the consultants Marsden Jacob and released in 2005 identified poor quality data and monitoring as a serious issue undermining effective water management in the MDB. Focusing on the Cap it found that:

From the perspective of the MDB as a whole, these reporting systems tend to be state and area focused with no comprehensive, consistent or integrated approach to ensuring reliability and confidence in Cap reporting. As a result, problems arise at system interfaces and a developed understanding of those risks must be built up State by State, valley by valley, However, more fundamental problems include:

The inaccuracy of the measurement at large bulk offtakes and river pumps throughout the MDB. Some of the bigger risks to the integrity of measurement as a whole receive lower priority than the smaller but more obvious risks;
The lack of national or MDB wide standards relating to, for instance, maximum allowable errors in diversion measurement at bulk offtakes and river pumps, or to the requirements for recalibration; and
The inadequacy of existing Cap reporting protocols setting out the obligations and responsibilities of the parties to the Cap.

The audit has found performance, commitment and resourcing to vary between the governments and be well short of the benchmark set in other measurement reporting and accounting systems94.

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It summarized the implications in these terms:

Errors in measurement are not simply a matter affecting Cap integrity alone. Errors in measurement have a pervasive effect undermining assessment and policy on:
- water use efficiency;
- the conduct of river operations,
- the data upon which hydrological models setting the Cap targets are based,
- the purchase of water for both environmental and consumptive uses, and
- assessment of environmental, third party and ecological impacts.\(^\text{95}\)

In other words without reasonable data and monitoring, meaningful management is not possible.

In addition to the difficulties created by these issues the Living Murray project is being implemented in the wider context of a continuing decline in environmental sustainability and resource security. With climate change looming the MDB Ministerial Council has commissioned a number of studies to provide more information about that and other such threats. The error margins applying to predictions of this sort are necessarily very large but it is already obvious that the changes ahead will require a reassessment of the assumptions underpinning water management in the MDB. Under current conditions inflows into streams in the MDB are about 24,000 GL a year. About half of that is diverted for irrigation and other uses such as industry and urban water supply (with irrigation constituting more than 95 percent of all diversions in the region). Given the losses to evaporation, seepage etc that extraction level is near the maximum level possible with current technology. Within this context one billion dollars has been allocated to the Living Murray project. However, reports prepared for the Ministerial Council predict that the benefits of the Living Murray project will be more than eroded by a number of factors predicted to reduce in-flows in coming decades.

Studies to assess future risks to inflows, commissioned by the MDB Ministerial Council, have focused on climate change and the reductions that will be caused by the growth in farm dams, new plantation forestry projects, increased groundwater pumping and improved channel and irrigation management. In light of these factors a major CSIRO study published in early 2006 predicted a decrease in stream flow of between 2,500 and 5000 GL over the coming twenty years. The situation is not expected to stabilize and predictions for the mid twenty first century are for a reduction in inflows of the order of 4,500 to 9000 GL.\(^\text{96}\) One implication is that water managers will not be able to negotiate the sharing of water between the environment and production as a one-off process. The system will have to be capable of continual adjustment. Another consideration is that most of the management options needed to respond to these threats are outside the ambit of the current MDB institutional framework.

The looseness of the existing institutional arrangements in the MDB is well illustrated by considering the following scenario, implementation of which is now being seriously considered by Victoria and New South Wales. The difference between


\(^{96}\) van Dijk et al ‘Risks to the Shared resources of the Murray-Darling Basin’
South Australia’s regular entitlement of 1850 gigalitres, as specified in the MDB Agreement, and the average flow over the border of just under 5000 gigalitres is very substantial\(^97\). While the Cap process limits the volume of water that can be used for human consumption, industry and agriculture, there is nothing in the MDB Agreement or other agreed policies that requires the two upper states to deliver more than the minimum at the border. This means that the very large difference of approximately 3000 GLs between the two flow figures could be used for environmental purposes in New South Wales and Victoria.

For the two up-river states this would produce major environmental improvements and ease the political pressure to reduce allocations to their irrigators to achieve that result. A typical use would be to pump this ‘environmental water’ onto a riverine wetland and let it work its way slowly back to the river. Taking account of losses with each use and increased salt and nutrients that would be picked up as it drained through the floodplain, this would allow a given environmental allocation to be used a number of times. This would result in considerable environmental benefits in the upper states but depending on how extensive the practice became it would also cause serious additional degradation in South Australia.

The salinity levels predicted by the Salinity Audit assumed that all water not used within the Cap in the upper states would flow across the South Australian border. Smaller flow volumes, however, would reduce the dilution of the saline groundwater seeping in from the Victorian and South Australian mallee and result in significantly higher salinity figures in the lower reaches than predicted by the Salinity Audit. It would also drastically reduce the frequency of low and medium level floods, thereby devastating the Murray’s flood plain in South Australia. According to the five-year review of the Cap on extractions, the current average flow over the border of just under 5000 GLs results in about a 28 % flow at the Murray Mouth compared with pre-development conditions. This reduction has increased the frequency of drought in the Coorong and around the lower lakes from about 5 % of years to over 60 %. To reduce flows over the border to 1850 GL, the minimum required by the MDB Agreement, would make that situation much worse (over 2000 GLs at the border is needed before there is flow out of the Murray Mouth).

Taking a Basin-wide perspective the potential benefits in the upper parts of the catchment may well out-weigh the costs to the lower reaches but the institutional arrangements now in place in the MDB mean that this scenario will not be subjected to the discipline of such a test. Veto by any one jurisdiction, either Victoria or New South Wales, would keep the issue off the agenda of the Ministerial Council. The lack of a comprehensive basin wide framework as shown by this issue significantly undermines the potential effectiveness of the efforts to implement integrated catchment management in South Australia.

\(^97\) This figure is based on flows over the past century. There has been almost no flow out of the Murray Mouth in recent years.
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