Murray-Darling Basin water management

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Introduction

The Murray–Darling Basin covers approximately a million square kilometres and is the most significant agricultural catchment within Australia (Figure 1). It represents about 40% of Australia's agricultural production, and approximately 70% of Australia's irrigated agriculture occurs in the Basin. There are very few agricultural products that aren't produced in the Basin, principally sugar and some tropical horticulture.

The Basin comprises 24 major rivers, the two largest being the River Murray (2,530 km long) and the Darling River (2,740 km long).

Despite the Basin's size, it only houses about 2 million people, the largest city within it being Canberra with a population of 300,000 people. Internationally this is a very significant area, a significant resource, but sparsely populated and the dominant water use within the Basin is irrigation. Stock and domestic use (on average half of Adelaide's water supply is drawn from the Basin) accounts for less than 5% of diversions.

The purpose of this paper is to provide both a technical understanding and a discussion of the policy issues concerning water quality, water quantity and water trading within the Murray–Darling Basin.

The Murray-Darling Basin Commission

The Murray–Darling Basin Commission has a significant history, and is unique both within Australia and internationally. Fundamentally it has been based upon the River Murray Commission which was established in 1914 as an outcome from the establishment of the Australian Constitution at Federation. It took the three lower states—South Australia, Victoria and New South Wales—the intervening 14 years to negotiate water-sharing arrangements around the River Murray.

The River Murray Commission existed until the mid-80s, at which time there was an agreement to establish a broader Basin, which was by then referred to as the Murray–Darling Basin, management group.
The Murray-Darling Basin is managed through six governments, with the relatively recent incorporation of ACT and Queensland. These six governments—the Commonwealth, four states and the Australian Capital Territory—act as partners in the management of the joint resources within the Murray-Darling Basin. These governments are each represented by their ministers, each of which jurisdictions can have up to three ministers representing the portfolios of land, water and environment. Whilst the Murray-Darling Basin Ministerial Council is chaired by the Commonwealth, all of the parties to the council are seen to have equal standing and decisions are taken on the basis of a unanimous position.

Advising the Ministerial Council is a Community Advisory Committee, drawn from each of the catchments within the Murray-Darling Basin. These representatives are usually the chairs of the respective Catchment Management Authorities or Catchment Management Boards. The Community Advisory Committee is a very powerful group of community representatives providing direct advice to Ministerial Council on issues for the Council to consider and on which to form positions.

Sitting beneath the Community Advisory Committee is the Murray-Darling Basin Commission with an independent president, two commissioners from each government and two deputy commissioners. Senior staff usually holds these positions from the agencies reporting to the ministers, at secretary or deputy secretary level. The office of the Murray-Darling Basin Commission, with a staff of 80 people, is based in Canberra, and provides administrative roles in the management of the Basin as well as natural resources management.

The Murray-Darling Basin Commission is a complex governance structure, demonstrably involving six governments, all of who must agree before particular actions can be taken, but all of whom then contribute jointly to the management of the resources of the most significant agricultural basin within Australia.

The charter of the Commission is:

To promote and coordinate effective planning and management for the equitable, efficient and sustainable use of land, water and other environmental resources.

Of importance are the concepts of promoting and coordinating. Fundamentally the structure and intent of this body is promotion and coordination, seeking to achieve equitable, efficient and sustainable use of resources—not conservation, but use of the resources. This provides guidance in terms of all the activities that the Murray-Darling Basin Commission engages in.

The functions of the Murray-Darling Basin Commission all fall within the constraints of integrated catchment activities. The four components in integrated catchment management are as follows.

1. Regional catchment organisations which are appropriately structured with both technical capacity and governance to pursue particular issues.
2. Targets for catchment health.
3. The national Basin or state policies or strategies allowing achievement of the benchmarks in particular catchment health areas.
4. Stable investment base and cost sharing supplying the funding to support the activities necessary to achieve the established targets.

Water Resources

Whilst the Murray-Darling Basin is considered to be the most significant agricultural basin in the country, it represents only 15% of the area of Australia. It is also a relatively poor performer in terms of the actual volume of water resources.
water generated through the basin. The Murray-Darling Basin only generates approximately 6.1% of the national surface run-off. Other areas especially in northern Australia contain basins smaller in area but with a higher proportion of the national run-off.

A consequence of generating only 6.1% of run-off is that water is fundamentally scarce within that environment. That scarcity has driven a range of government initiatives and community development over the past 140 years. Governments have then sought to invest in more effective water management and, given the vagaries of the Australian climate, investment in irrigation and water resource management for irrigation has been fundamental government policy for the last 100 years.

That government policy has then seen the construction of a whole range of water storages and water structures in order to support irrigation, the most recently completed being Dartmouth Dam at the top end of the Mitta Mitta-Murray system, the largest dam on mainland Australia. Over the last 80 years, there has been a very significant increase in the total volumes of storage capacity within the Murray-Darling Basin system.

Figure 3 shows that the total Basin storage capacity is approximately twice the volume of the long-term average natural flows to the sea. By international standards the Basin is very highly regulated.

Diversions taken from the river systems have increased from 1920 through to the mid-1990s. These increases in diversions have been supported by the increases in the storage capacity, so that the river can be more effectively regulated. The greater security provided to water users allowed them the confidence to develop an irrigation industry and draw upon the water resource. Nevertheless, there was great concern in the 1990s about the trend of the diversions curve. Extrapolation led to the possibility that, on average, all of the water would be taken out of the River Murray, leading to speculation about the need to limit the level of diversions occurring at that time.

These concerns led to an audit of water use within the Murray-Darling Basin and recognition that unless actions were taken, the growth in diversions between 1950 and 1994 would result in the extraction of more water out of the system than actually existed. A fundamental policy decision ensued, which was probably the most significant in Australia’s water resource management history. This policy implemented a cap on diversions to limit the volumes of water that can be taken out at any time to the 1993–1994 levels of development of the resource. This cap was not on the actual volume of diversions but on the actual level of development. This has created security for existing water users and also provided a datum point for the protection of the environment within the River Murray and its supporting tributaries in terms of maintenance of flows for environmental needs.
The outcome of this cap has been an irrigation industry that is highly productive. The Basin has achieved highly competitive international standards, in terms of its productivity, its water use efficiency and its capacity to generate income, predominantly from exports. This important industry is now facing some further challenges in terms of its future access to water resources, and what future direction it will take.

However, there are some policy dilemmas here, too, for governments. The National Land and Water Resources Audit reviewed the profitability of Australian agriculture for the five years from 1991 to 1996. The profit at full equity (i.e., the actual financial returns that farmers were estimated to be making exclusive of interest charges) ranged between minus $5 per hectare, through to about $1,000 a hectare. For the vast majority of the Murray-Darling Basin (Figure 5) the returns were either negative or less than $50 a hectare. It is speculative to suggest that the situation has changed dramatically since that time.

If this data is sieved to calculate the area that contributes 80% of the total profit to full equity, this data in Figure 6 shows that less than 2% of the area generates 80% of the agricultural profit within the Basin. Detailed examination of the red dots in Figure 6 shows that they represent irrigation activities. In broad general terms, in the northern areas of the Basin the enterprises are predominantly cotton with some tropical agricultural activities; those in northern Victoria are primarily dairy with viticulture predominant in South Australia. Viticulture is estimated to represent up to 80% of the agricultural profit at this time.

From a public policy perspective this concentration of agricultural profit has created a dilemma. The Commission’s role is to manage resources jointly and equitably, seeking effective outcomes. If the focus is on financial returns, what issues need to be considered if 80% of the agricultural profit is generated from 2% of the area through irrigation? The Commission needs to determine how it manages the balance of the area in order to ensure the sustainability of this irrigation industry.

**Targets for Catchment Health**

In 2001, the Murray-Darling Basin Ministerial Council agreed to an integrated catchment management policy, which identified a range of attributes within the policy. More importantly, for the first time it provided some guidance of issues that are seen as significant to the long-term maintenance of overall catchment health.

The issues identified were water quality, water quantity through water sharing, terrestrial biodiversity and ecosystem health. The Ministerial Council then approved a timeline for the establishment of targets to be established at either a catchment or subregional scale (Figure 7). These targets would then guide actions to achieve overall catchment health by the end of the current decade.

**Salinity Strategies**

Salinity is a major issue within the Murray-Darling Basin, the extent of which is not precisely known. The Commission undertook an audit throughout the Murray-Darling Basin in 1996 identifying the occurrence of salinity within the Basin (Figure 8). Along the western slopes of the Great Dividing Range there are widespread significant outbreaks of salinity. In northern Victoria and lower sections of the Murray in terms of South Australia, there is also widespread evidence of salinity problems.

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**Figure 6. Identification of the farms contributing 80% of the PFE in the Basin.**

**Figure 7. Targets for catchment health.**
In Victoria alone, it has been forecast that salinity will have fundamentally affected more than 843,000 hectares by the year 2100 (Figure 9). This area excludes any irrigation area. The land will mainly be affected as a result of groundwater depths of less than two metres across the vast majority of that area. The Commission has a good understanding of salinity impacts within the irrigated areas, but much of the surrounding dryland area will be affected through salinity in the absence of specific activity.

In 2001 the Murray-Darling Basin Ministerial Council released a Salinity Strategy providing an overview for actions being taken by each of the jurisdictions. This comprehensive strategy dealt with a range of actions that are to be taken both at a catchment and state level. State strategies are driving activities to deliver a long-term target at the bottom end of the river system. The salinity level at Morgan in South Australia has been selected as the datum point to measure the strategy’s success. The target is for the salinity level to be maintained at less than 800 EC units for more than 95% of the time. This level of 800 EC units is the World Health Organisation’s standard for good quality drinking water.

A number of other strategies are also currently being developed throughout the Basin.

- an irrigation and land water management plan within the southern section of the Basin;
- catchment management strategies in the northern part of the Basin;
- end of valley targets within communities in north and central NSW;
- farming systems development;
- forestry for environmental services, despite some ongoing problems with tree clearing in the northern part of the Basin; and
- joint salt interception schemes in the Lower Murray providing salinity credits to offset actions elsewhere within the Basin.
Land use within the Basin is extremely diverse, although they are all relatively structured. Strip cropping is extensive in the northern part of the Basin, but there is a progressively better understanding of salinity, its causes and its potential mitigation. As a result land uses will become more tailored at a smaller scale to particular land forms and particular land use issues, establishing a mosaic farming system to deal with resource management issues.

Water Sharing

Water sharing is the basis of a new policy discussion paper developed on the foundation of an audit of water resources within the Basin— not only what quantities of water exist, but how that water is currently being used. Figure 10 illustrates the proportion, expressed as pie charts, of the water that remains within the river system versus that which occurred prior to development.

For example, in the Snowy River just below Jindabyne 99% of the water has been taken out of the river, which only sees 1% of the water that it would have seen previously under natural conditions. Conversely the Ovens River, just downstream from Albury, is largely undeveloped and the water in the river is about 99% of what would be there under natural conditions. Further downstream in the Goulburn and Murrumbidgee Rivers there is only about a third of the water left in the river. The Upper Darling above Menindee retains about two-thirds of the water. At the mouth of the River Murray, approximately three-quarters of the water has actually been taken out of the river. Approximately 96% of the diversions have been for irrigation purposes. Despite the fact that the River Murray provides on average half of Adelaide's water supply, stock and domestic accounts for only 4% of diversion. On an international comparison, the impact and demands for industry and human consumption are trivial for a river of this size across that scale of landscape.

As a consequence, from the river’s perspective there are serious issues in terms of river health and there is a broad range in the condition or likely condition of the river on the basis of water extraction depending upon location within the Basin. In May 2002, the Murray-Darling Basin Ministerial Council agreed to examine three reference points, which represent the impact of additional water flowing through the Basin by returning three different volumes of water for the River Murray— 350, 750 and 1,500 gigalitres. The riverine ecologists believe that, despite increased flows at the Murray mouth, there would only be small changes in riverine habitat quality. There would be no significant positive impact on riverine health unless an additional 1,500 gigalitres flow is made available through a range of structural options improving management of river flow.

The Murray-Darling Basin Ministerial Council has released The Living Murray, a discussion paper on restoring...
the health of the River Murray (2002). There will be decisions made over the next 12 to 18 months on the outcomes of this discussion process, which will impact upon those within the Basin. The governments in Western Australia and Tasmania are also expected to follow this policy direction which largely reflects a change in social attitudes, and a change in the relative significance of irrigation and development as opposed to the relative needs of the environment.

**Water Market Reform**

It has been well recognised that there must be five attributes to allow the establishment of an effective water market.

- Water property rights: the ability to clearly define property rights, not only for water but also in relation to land clearing.
- Exchange rates for rights: the protocol for exchanging those water rights. The water rights vary depending upon the system within which it is located, and a methodology is required for calculating conversions between different rights and if they are tradable.
- Environmental clearances: what will be the impact of taking water from one place to another place, both in terms of where you’ve taken the water from and where you’re taking the water to and what are the impacts along the way?
- Water accounting: it is necessary to know if water accounts have been actually transferred to another entity. To effectively manage the supply, it is also essential that the regional supplier authority understands how many customers it actually has and where water is demanded.
- Institutional/Administration: water trading needs adequate resource institutional and administrative arrangements so that the process can be effectively managed, tracked and reported.

In 1994 the Council of Australian Governments (COAG), under national competition policy, agreed to implement a package of water reform measures. This package required that the individual jurisdictions establish water-trading markets. Since 1993–1994, the actual volumes of trade have increased significantly. The majority to date has been temporary trade with some minor permanent trade (Figure 11).

Many non-horticultural irrigators, principally dairy, over the last two to four years have become adept at participating in the temporary water market because the volumes they have normally relied upon have not been in storage. During the same period of time, water prices have increased significantly (Figure 12). Currently prices for permanent transfer are maintained at $900 to $1,000 per megalitre for high-security water in Victoria. Water is a fundamental asset and the majority of land-holders or entitlement holders are recognising it as such. Many of them are also now far more active within the market, trying to draw upon that asset in order to extract some annual returns.

As an example there are areas, near Kerang and Swan Hill, with C or D-class soils that are fundamentally salinised with a relatively low level of potential production. Landowners have then been looking at making value out of the water resource through the water trading market rather than out of the land. In the Goulburn-Murray trading or management area, there have been significant trades into and out of the district in the last 10 years (Figure 13), the volumes traded being significant. In addition to local trading, there has been approximately 25,000 megalitres
traded out of the district into South Australia. There has been significant movement of water out of the district into areas that can use it more effectively.

The Murray-Darling Basin Commission has an interstate water-trading project based in the Mallee zone, downstream from Robinvale. The project has sought to establish some parity of arrangements between Victoria, New South Wales and South Australia, and to facilitate the permanent transfer of water. Currently about 11,000 megalitres have moved out of mainly New South Wales and some from Victoria into South Australia, and virtually all of that water has gone or is going into high-value viticulture industry development.

The challenge for the Landscapes and Industries Program for the Murray-Darling Basin in relation to environmental flows, is to look at the expansion of this interstate trading zone up the Darling into the Murrumbidgee, and then into the Goulburn system. Within five years it is hoped that water would be able to be traded across the whole of the Basin.