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Insights and lessons from improved regional water security and integration in Australia

ABSTRACT

The Murray-Darling Basin (MDB) in Australia provides a leading example of a region that has established wide-ranging transboundary water agreements. The MDB extends into four states and one territory, and they have disagreed continuously over water sharing since Federation in 1901. The first major transboundary water agreement was the 1915 River Murray Waters Agreement, which was followed a century later by the 2012 Basin Plan. One of the objectives of the Basin Plan is to reallocate 2,750 GL from consumptive to environmental use in the MDB. Although the Basin Plan built on many other water reforms of the previous century, it does represent the most significant effort to estimate sustainable water use levels in the Basin and value the benefits and costs of various water reallocation scenarios. This study provides an overview of the major water policy reforms in the Murray-Darling Basin, and reviews the identified benefits and costs of the 2012 Basin Plan. A number of insights and lessons are then drawn. Overall, the results signal that the quantified benefits of the Plan seem to outweigh the costs by up to three times. However, there are lessons to be learned from the extensive consultation, valuation and compensation paths that were adopted in Australia. It may not be possible for many other countries to implement such paths. Although Australia is on a path to sustainable water extraction, there is still much to be done and further policy will need to be flexible enough to allow further adaptation and innovation.

Keywords: *Basin Plan, benefits and costs, transboundary agreement*

1. Introduction

Water has been always been a source of conflict, and especially so in the context of transboundary water resources where water governance is shared by different countries, legal systems, populations etc. Policies that promoted unsustainable water consumption resulted in rivers running dry and water quality deterioration [1]. A lack of governance and cooperation in transboundary water management can have economic, environmental and social impacts. As such, a variety of commissions on transboundary waters have been established; for example, the United Nations Economic Commissions for Europe (UNECE) Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) in 1992, with amendments in 2003 to allow accession for all United Nation members (which came into force on 6 February 2013).

There have been many institutions put in place over the last few decades for managing transboundary issues (e.g. [2]). However, there is confusion and lack of awareness about the benefits that may arise from improved transboundary water cooperation by many countries. As such, there is a growing demand by countries for quantitative information on the potential benefits of transboundary water cooperation.

The MDB in Australia provides an example of the potential benefits to be derived from implementing transboundary water reform, albeit over states within a single country. It has been used as an example in many analyses of the impacts of water scarcity (e.g. [3]). Water reform in the MDB has been a constant process over the past century. Such reforms have led to well developed water entitlement and allocation markets, and, as such, Australia provides a leading example, across the world, of water demand management using water markets [3,4,5]. Moreover, Australia inaugurated reforms in water demand management earlier than most other jurisdictions. While Australia began its reforms in the 1980s, it was not until the 1992 Earth Summit, in Rio de Janeiro, that there was a commitment amongst the international community to an increased focus on water demand management [6].

This paper provides an overview of the history of water reform in Australia, detailing the problems experienced due to lack of cooperation and coordination between states, and how various reforms and policies have been implemented to encourage coordination. It highlights lessons to be learned from water policy reform in Australia, and in particular comments upon recent work conducted on water markets and the recent Basin Plan that was adopted in 2012. The benefits and costs of the Plan are reviewed in detail, with a heuristic assessment of the net benefits undertaken. It then concludes with a section summarising some of the insights and lessons the international community can learn from the Australian situation.

2. Murray-Darling Basin

2.1 MDB Background

The MDB is a large geographical area (1,061,469 km^2) in southeastern Australia, whose name is derived from its two major rivers, the Murray River (2,530 km long) and the Darling River (1,472 km long). It drains around one-seventh of the Australian land mass, and is one of the most significant agricultural areas in Australia. The MDB covers four states and one territory (catchment area is shown in Figure 1 [7]) in Australia. In particular, it spans most of the states of New South Wales, Victoria, and the Australian Capital Territory, and parts of Queensland (lower third) and South Australia (south-east corner). The River Murray travels through three states: New South Wales (NSW), Victoria (VIC) and South Australia (SA).

Figure 1: The MDB with major irrigation districts

The MDB is an iconic area for agricultural production (it produces over one third of Australia's food supply and is known as Australia's 'food bowl'); ecological importance (e.g. Ramsar wetlands, up to 30,000 wetlands, 2,442 key environmental assets); recreational significance and cultural values (home to 34 indigenous groups). 65% of Australia's irrigated land is located here, and it is home to over two million people [8]. There is a diversity of agricultural crops across the Basin. Horticulture dominates in SA, dairy in VIC and broadacre (rice, cotton) in southern NSW.

Agricultural access to water in the MDB is subject to considerable variation within and between years, and across lengthy periods. Rainfall is the key climate variable that governs the spatial and temporal availability of water [8]. Over the last 120 years, there have been a number of notable droughts in the MDB (Figure 2 [9]): the Federation drought (1895-1902), the World War II drought (1937-1945), and the Millennium drought (1997-2009).

Figure 2: MDB flows 1890–2000s.

The recent Millennium drought caused severe reductions in water runoff and water use in the MDB, resulting in water quality issues, biodiversity conservation loss and ecosystem function disruption [8]. Such issues led to the Commonwealth government demanding the need for a comprehensive, coordinated Basin plan across all states, as elaborated further in Section 5.

2.2 MDB Institutions

New institutional economists have continually emphasised the importance of considering institutions and organisations in policy reform. Institutions have tended to be defined as the "rules of the game", consisting of both the formal legal rules and the informal social norms that govern individual behaviour and structure social interactions (institutional frameworks). Organisations are not the rules of the game, they are the 'actors' in the game, and include political, economic, environmental and social bodies). A combination of Williamson's [10; 597] delineation of four levels of institution in the Australian water policy context is profiled in Table 1.

Table 1: Water Institutions in Australia

Current organisations in the MDB who play a role include political (Commonwealth, state governments); agricultural (farmer lobbies); environmental (Australian Conservation Foundation); NGOs; scientific (Wentworth Group); and managers (Murray-Darling Basin Authority). Williamson outlined that there is a complex relationship between all levels of institutions, with influence radiating from level one down to level four, but that the influence also radiates from changing the fourth level back to the beginning. Indeed, in the water resource case, the situation is even more complex as there are a multitude of influences on water policy, not to mention the links with environmental attributes, contextual factors (drought, water scarcity) and social aspects. The following section outlines the process of reform that has occurred in the MDB.

3. Historical Water and Institutional Reform in the MDB

European settlement in Australia in 1778 saw the adoption of British style institutions and, in particular, English riparian doctrine and common laws which gave strong powers to colonies. In terms of water use, the riparian doctrine was found wanting because it excluded non-riparian water use (e.g. gold mining ventures in the 1850s) throughout the 19th century. A Royal Commission was appointed in 1884 by the Victorian colonial Government to examine alternative water doctrines. The Deakin Commission led to the creation of the *Irrigation Act 1886* in Victoria. The Act nationalized the right to use water, abolished any new riparian rights, gave easement to aqueducts to non-riparian farmers, formalised a licensing system. The Act effectively replaced existing rights with statutory rights in order to assert State authority, which was criticized by a number as socialism in action [11].

Before the Federation of Australia, which came into force on 1 January 1901, there were six separate British self-governing colonies: Queensland, NSW, VIC, Tasmania, SA, and Western Australia. These colonies became states of the Commonwealth of Australia. States kept the systems of government that they had developed as colonies and from English traditions, but there was also now a federal government responsible for national matters. Water was one of the battlegrounds for the colonies and for keeping state sovereignty in the development of the Federation. VIC and NSW wanted water for irrigation development, SA primarily for transport. Early Constitutional recognition gave states considerable power to own and allocate water, and this continues to exercise influence on contemporary water resource management in Australia. Tisdell [11] and NWC [12] provide more historical background on Australia's legislative water market policy development, while Davidson [13] provides the classic text on the history of irrigation development in Australia.

The first major transboundary water agreement (a level two institution) occurred after the Federation drought (see Figure 3). The *1915 River Murray Waters Agreement* was a result of many years of negotiation between the states and provided the first catchment-wide agreement in the MDB [14]. This agreement is key, all following agreements and policies were only possible because of the *River Murray Waters Agreement*. The River Murray Commission was established in 1917, albeit had limited powers and was mainly associated with river management, not environmental or other concerns. It is important to note that this agreement was not driven by institutional reform or establishment. The agreement (a level two institution according to Williamson's framework) was established because of extreme scarcity, which in turn influenced a level three institution (a management organisation) which went onto to continue to make level four water management institutional changes. The history of institutional change in the MDB has many examples of where drought scarcity has been the catalyst. This brings us to the first two lessons of this paper, namely:

Lesson One: Droughts or crises are critical to encourage cooperation and coordination of water reform, and to drive through institutional change in the form of transboundary agreements.

Lesson Two: Water reforms are driven by a complex interaction of multi-layer, path-dependent influences, with reforms building upon many previous waves of institutional reform.

Figure 3 illustrates the long-term nature of lesson two and water reform in Australia, originating from the original 1915 water agreement. Water policy in Australia is depicted in this diagram as 'waves of reform', triggered by serious droughts and environmental concerns. The River Murray Waters Agreement in 1915 provided for equal flow-sharing between NSW and VIC, state control of tributaries and a guaranteed minimum entitlement for SA. Being at the bottom of the river, SA suffered the most from reduced flows, and hence had the most to benefit from a transboundary agreement. Figure 4 [Quiz, 4 1904, p. 1, reproduced in 12] highlights the imbalance in state power.

Figure 3 Progress towards a full transboundary agreement in the MDB, 1915 to 2012

Figure 4: State Conflict over River Murray Water

The subsequent importance of water and state conflicts motivated the Commonwealth government to significantly invest in MDB irrigation activities between 1918 and the 1970s [12]. The goal of taming the rivers, the Snowy Mountain scheme, and greening the desert and making land productive all were social norms in the Australian psyche for much of the twentieth century, representing a Level One institution embeddedness in Williamson's [10] framework. This norm is still very much present in Australia.

During this period, major infrastructure projects (e.g. dams and weirs) were constructed, and the total storage available from this development is now just under 35,000 gigalitres (GL) [11]. Coupled with this increase in water supply storage, Australia was in a relatively wet period from the 1950s to the 1990s, unlike the previous half of the century. These factors led to this being the period when most water entitlements were granted, causing serious problems with over-extraction when severe droughts returned. This phase of water policy, up to the

1980s, is often referred to as the "expansionary or development phase" [12]. Expressed differently, it was mainly focussed on water supply rather than water demand.

A number of key developments started to redirect the focus from supply management towards demand management in the MDB. First, the earliest motives for Australian water trade generally stemmed from water scarcity as a consequence of drought or regulatory pressures. There is anecdotal evidence that during Australia's World Water II drought unofficial temporary water trades occurred [12]. In the late 1960s an awareness of over-allocation emerged, and states (starting with SA) commenced placing moratoriums on the issue of new water entitlements. NSW adopted a full embargo in 1981, and Victoria restricted unregulated stream use after 1968. Such restrictions led to informal MDB markets for seasonal water in the 1960s and 1970s [15].

Given the increasing recognition about over-allocation issues and environmental problems, government interest in agricultural protection and supply management began to wane in the 1970s and 1980s and attention turned to water demand management. As a consequence, the mandate of the River Murray Commission was expanded from managing water demand to include water quality issues [16]. This change in policy, and the previous experience with informal water markets, meant that more focus and attention were given to water markets as a reallocation tool. Temporary transfers of water rights were permitted in NSW during the droughts of 1966–67 and 1972–73, in Victoria during 1966–67, and, in a restricted version, over the period from 1982–83 to not long before its more general introduction in 1986–87. These limited examples of water trading were one-off responses to isolated and temporary water shortages, but they became the precursor to more formal water markets [12]. SA was the first state to develop markets for the formal transfer of water entitlement and allocations in 1983 [17]. Formal trade within irrigation districts in other states began in the 1980s, trade between private diverters and district irrigators was allowed in 1995, and the unbundling of land and water rights soon followed [12]. Inter-district trade is very important, because it represents the first trans-boundary water transfers in Australia. However, irrigators remained wary of water markets, and trade was far from common during the 1980s to the mid-1990s (as highlighted later in Section 4).

The growing problem of environmental problems, particularly salinity issues and algal blooms in the 1980s, saw the real recognition of the need to manage these issues, and the River Murray Commission powers were extended once again [16]. This led to the second main phase of Australian water policy, known as the "maturity or scarcity phase". The era of the 1980s was characterized by the need to address sustainability, rather than focussing on regional development and the formation of engineering solutions [12]. It also gave rise to the development of water demand management. This is also the start of where an attempt was made to try and change the embeddedness of a level one institution: namely the predominant view that consumptive use of water was the most important factor. This is where the case for considering the environment and long-term sustainability became much more important, albeit it was not to the 2000s that the environment was intrinsically part of the water management decision in Australia.

The introduction of water as an economic commodity has been met with resistance. Steps toward market development were incremental and initially trade was only allowed in the allocation market [18]. By the 1990s, there was a broadening of water reform and trade, with growing calls for federal involvement, because states could not sufficiently coordinate or cooperate to achieve necessary goals. Following federal-state negotiation, a new MDB Agreement was crafted in 1992; it was supported and maintained by the creation of the

Council of Australian Governments (COAG). This created a new water reform era in Australia.

The current stage of water market development in Australia (2000s onwards) is characterized by major transboundary reforms (levels two, three and four of institutions) to ensure that water markets address scarcity issues and sustainability requirements. This is discussed further in Section 5.

4. Water Markets in the Murray-Darling Basin

There are two water markets in Australia: the entitlement and allocation markets. The entitlement market allows trade of water access entitlements (otherwise known as permanent water). These provide exclusive access to a share of the water resources within a water resource plan area (predominantly in perpetuity). These entitlements yield seasonal volumetric water allocations which can be extracted from the water source during that season and put to beneficial use by holders of a water access right. These allocations are announced at the beginning of each season as a percentage the total access right, which is dependent on seasonal conditions. The second market, the allocation market, is where seasonal allocations are traded (otherwise known as temporary water). Figure 5 [19; p. 7] illustrates the principal surface water trading areas in Australia, as at 2012.

Figure 5 Surface Water Trade Areas in Australia.

Irrigators can buy and/or sell water from brokers though online platforms, telephone sales, or manual sales. Formal water markets began as uniform price open call markets, though a variety of other water markets (such as double auction water markets) have been used [20]. Online platforms typically collect weekly offers for water allocation trade through water exchanges, with a pool price formed to maximize trade volumes.

Table 2 (adapted from data in NWC [19]) illustrates the current state of trade in Australia in regulated and unregulated systems. Water entitlements exist in both regulated systems (flows controlled through infrastructure that stores and releases water) and unregulated systems (not controlled through infrastructure use). Regulated water entitlements have different levels of reliability (classified as high, general and low) by area in the MDB, while unregulated systems have no formal reliability (and are usually determined by restrictions on extraction).

Table 2 Australian entitlement and allocation trade volumes (GL) in 2011-12

Table 2 clearly shows that water trade in the MDB outweighs trade elsewhere—MDB trade comprised 94% of the total volume of trade in Australia in 2010–11 and 2011-12 [19]. In the MDB, the southern part has most of the trade because much of it is hydrologically connected. The northern and southern MDB are not hydrologically linked and therefore trade between them is not possible.

The wide range of water policy reform that has been undertaken in Australia, since the early 1900s, has resulted in water becoming regarded much more as an economic and transferable commodity. Reforms, coupled with increasing water scarcity and severe drought, has meant that the adoption and use of water markets in Australia has increased rapidly in the past three decades (Figure 6 [sourced from data in 19,21,22]).

Figure 6: Water trade in the southern MDB

Studies that have profiled the influences on irrigators' adoption of water markets find that early adopters were more likely to: be more educated and have a farm plan, have higher incomes and have worked less years on the farm, and be female. Other variables, however, indicated that influences (such as region, water allocations, farming technology, outputs and farm type) were also important for water trade adoption [23,24].

There was an exponential increase in water trade adoption from 2006-07 onwards in the MDB, driven primarily by water scarcity and government buy-back of water entitlements, but also various commodity prices. The water allocation market was adopted far earlier than the water entitlement market (Figure 6). 86% of NSW irrigators had engaged in at least one water trade by 2010-11 (either allocation or entitlement), compared to 77% in Victoria and 63% in SA. NSW irrigators were more likely to have adopted water allocation trade than Victorian or SA irrigators, while Victorian irrigators were more likely to have adopted water entitlement trade than SA or NSW irrigators [4].

What has been the overall benefit of having a water market in place in Australia? Such a question has been considered in many different studies, via many different methodologies (e.g. [25,26,27]). Table 3 provides a summary of some of the key literature in this area that has estimated dollar values of the net benefit of water market presence. Although it is difficult to directly compare the dollar values given differing methodologies, timeperiods and scenarios modelled, it is clear that economic studies show that there are considerable economic and financial benefits that have been derived from having water markets in place in Australia.

Table 3: Summary of water trade studies in Australia

Overall, it is generally agreed that water markets have provided a variety of benefits for farmers in Australia [4]. Farmers use a combination of participation in the entitlement and allocation markets to help them optimize the management of their businesses. Selling some water entitlements allows a reduction in farm debt; facilitates retirement; or is sometimes used for farm restructure [33]. Trading water allocations allows farmers greater flexibility, during the course of a season, to adjust their mix of inputs, or to hedge against the risk of water uncertainty and losing long-lived assets (e.g. herd size in the dairy sector and perennial crops in horticulture). In particular, the ability to trade water in the MDB has played a critical role in maintaining irrigation sector income during drought. However, it is essential to note that the adaptive capacity of the irrigation industry was significantly enhanced because of the diversity of different types of agricultural production in the MDB, and, in particular, by the presence of opportunistic annual crops (e.g. cotton and rice) in the MDB. Although it is often argued that Australia should not be growing cotton or rice due to their high water use, this ignores the adaptability of such crops in dry and wet conditions, and the role those farmers play in providing water to more permanent crop irrigators in times of drought. For example, when water allocations were too low to allow for rice or cotton to be planted, many of these farmers sold water allocations to farmers' downstream, notably to dairy farmers in Victoria and horticultural farmers in SA at around AUD$1,000/ML [27]. This brings us to our key lesson three:

Lesson Three: Adaptation of farmers is most enhanced in situations where there is diversity of production, property rights in water, ability to trade water, and an ability to choose different forms of production or crop choice.

Such a lesson is supported by [52] that illustrated the net sum benefit of having additional states in the MDB engaging in trade. That is not to say that there are not many areas where there could be considerable improvement in Australian water markets. For example, there is the opportunity for considerable expansion into alternative derivatives [20] and large improvements that could be made in institutional reform and information (see [4] for greater discussion). Table 5 also highlights the water market Basin reforms.

5. The net benefits of current Australian water policy reform

5.1 Background of Australian water policy reform in the 2000s

The current phase of Australian water policy (from the 2000s onwards), is often referred to as the "transition to environmental sustainability" phase [12]. This phase was driven by one of the most serious droughts the MDB has experienced; the Millennium drought.

The Commonwealth has assumed an increasingly active role in MDB water policy to ensure state collaboration and coordination (for example, the Murray-Darling Basin Commission was established in 1988 and the National Water Initiative in 2004). The 2004 inter-governmental agreement was aimed at addressing over-allocation and achieving environmental objectives in the MDB; it assigned AUD$500 million to secure 500 GL of water for key environmental assets in the MDB. The major water reform was the introduction of a Commonwealth Water Act (2007), which required massive legislative, regulatory and stakeholder reform. This act followed on from the introduction of the *National Plan for Water Security* in early 2007 (which became *Water for the Future* in 2008). New administrative bodies such as the Murray-Darling Basin Authority (MDBA) replaced the MDB Commission, with greater budgets and duties given to the MDBA.

In addition, the Commonwealth Environmental Water Holder (now the Commonwealth Environmental Water Office) was also created to manage acquired consumptive water and thereby increase environmental flows [34].

Water for the Future (WFF) was initially an AUD$12.9 billion investment over 10 years to 2018-19, with significant emphasis placed on the role of water markets to voluntarily recover water for the environment. It is planned to recover other environmental water through infrastructure investment. There has been considerable economic research conducted on the costs of returning water under both scenarios. Up to 2012, the mean market purchase price, accounting for reliability differences, was AUD$1,450/ML; while the mean $/ML associated with infrastructure investment to obtain water has fluctuated between AUD$2,340/ML (average costs from 2004 to 2009) to AUD$5,109/ML (average cost from 2009-2012) [35]. Additional funding of up to AUD$310 million per annum for 2014-15 has been provided to bridge any remaining gap between the level of water returned to the MDB under existing WFF initiatives and the level required to be returned under the final MDB Plan [33].

One of the goals of the new independent MDBA was to establish an independent, Basin-wide plan for water sustainability. A guide to a Basin Plan was released in 2010, which called for environmental water holdings to be increased by 3000-4000 GL annually, which represents an average reduction in current watercourse consumption diversions of 27-37% [8]. The Guide created enormous upheaval in the rural communities along MDB, with many arguing that the MDBA had not considered the social cost of such a water policy. Tractors stormed the streets; copies of the Guide to the MDB Plan were burned, or walked the plank to be drowned, ripped apart etc. In general, community consultation was loud and angry, and was dominated by anti-Plan sentiments. One of the drivers of this general unrest was that the release of the Guide had been clouded in secrecy, with very little consultation at all (including the relevant states). This secrecy was coupled with inaccurate media coverage of the Guide (for example, many stories ignored the fact that the reallocation of water from irrigation to the environment was only to come from willing sellers), this served to inflame rural uncertainty and general discontent. The lesson to be learned from this was:

Lesson Four: Involve and consult all stakeholders in the process as early as possible, and keep communication lines open.

Social concerns about the policy included: community vulnerability to the adverse effects of water sales; impacts on community spending and reinvestment; population losses as farmers elected to move out of regional areas once water sales had been finalised; impacts on current and future local employment prospects, especially for younger people; changes to the nature of production in regional areas (e.g. shifts to dry-land agricultural practices); legacy issues for remaining farmers such as higher variable farm operating costs, stranded asset problems, increased emphasis on the rationalisation of remaining 'outer' arm units etc. [4,36]. At the same time, various scientists and environmentalists have vigorously argued that the environmental water reallocations in the Plan were not large enough, and needed to be significantly higher to achieve true environmental sustainability (e.g. [37]). Indeed, many scientists point to the initial Guide of 2010, which considered that as much as 7,600 GL needed to be reallocated; but the Guide did not recommend this because of the social cost generated by such a reallocation [8]. Scientists have also argued that the draft Plan made inadequate allowance for the loss of water expected with climate change, and that groundwater reserves and use have not been properly accounted for [4]. Taking into consideration the insight from lesson two about the path dependent nature of many water reforms, the increasing preference for environmental attributes in society in general over time and the difference between scientist views and policy views, this does lead us to:

Lesson Five: It is possible that no water management plan will ever reach a 'sustainable extraction point' at any one point in time; hence this reinforces the need for flexible and adaptive institutions and policies to allow incorporation of future changes as necessary.

Australian states also generally took different positions on the Plan. SA, the state at the bottom of the river—hence suffering the greatest environmental consequences of low environmental flows—threatened a High Court challenge to try and enforce a greater return of water to the environment. But, at the same time, the SA state government ran the argument that although SA wanted more environmental flows; they did not believe that the water for those flows should correspondingly be bought from SA irrigators. Such a stance is inconsistent, and also ignores the fact that SA irrigators have the highest propensity to want to sell water entitlements across NWC, Victoria and SA (e.g. see Wheeler et al. [38]). Lessons learned from this include:

Lesson Six: An overall authority is needed to coordinate reform and encourage cooperation for water reform that crosses boundaries.

Lesson Seven: An agitator country/state plays an important role in demanding reform.

5.2 Evaluating the Net Transboundary Benefits of the MDB Plan

The growing level of discontent and negative reaction led to a Commonwealth inquiry [36]; the resignation of the head of the MDBA; increased rural community structural adjustment policies; increased expenditure on irrigation infrastructure to recover water, and, finally, to substantial reductions in the targets for environmental water holdings in the final Basin Plan.

There was also huge expenditure on economic and social consultancies, trying to establish the benefits and costs, as well as significant 20-week community consultation period. These created large transaction costs [39].

Part of this process involved funding millions of dollars towards ecological and hydrological analyses to estimate “environmentally sustainable level of takes” for surface water regions and sub-regions in the Basin, as well as setting proposed groundwater baselines and sustainable diversion limits and assessing the impacts of removing system constraints.

In addition, the MDBA funded socio-economic research work into: a) baseline socio-economic circumstances (profiling using population and census data); b) economic modelling and analysis (e.g. ABARES AusRegion CGE model, University of Queensland’s state contingent model, Monash COPs model); c) local profiles and assessments; d) farm surveys of farmers to suggest exit probabilities; d) social analysis to identify indicators of community vulnerability and adaptive capacity; e) impact of the change in water availability on indigenous populations; f) an assessment of the ecological and economic benefits of environmental water, and g) assessment of benefits for boating, fishing and floodplain agriculture [40].

In parallel, various interested parties commissioned their own studies into the social impacts of the plan, (e.g. studies were commissioned by: RDA Riverina; Griffith City Council; Coleambally Irrigation, Murrumbidgee Irrigation; the Wine Grapes Marketing Board; the Central Murray group of councils, and Narromine and Warren councils) [40]. All of this work meant that the MDBA collected (and had provided to it) a wide range of information on benefits and costs of various transboundary water agreements in the MDB.

In November 2012, the federal Parliament passed the MDB Plan into law, confirming a target for sustainable diversion that limited recovery volumes to 2,750 GL. Total water recovery is to be achieved by 2019, with a performance (and target) review process scheduled for 2015 [41]. It is also anticipated that 450 GL/pa of additional water for the environment could be recovered through infrastructure investment expenditure, which would bring total water recovery up to 3,200 GL/y. The Commonwealth committed AUD$1.77 billion over ten years from 2014 for this [40]. This commitment to additional water under the Plan was one of the reasons SA did not pursue a High Court challenge to the Plan. Community anger at the Plan has correspondingly died down. One reason for this is that many irrigators want the opportunity to sell their water entitlements to government, because they often have surplus water and the sale proceeds allows them to reduce debt and provide an income in lean farming times [33,35].

As a result of this lengthy process of developing, adjusting and implementing the Basin Plan in Australia one might well ask has the significant time, trouble and expense been worthwhile? To answer that, we now examine the benefits and costs of the Plan in Australia. Before the MDB Plan could be passed into law, the MDBA prepared a regulatory impact statement which summarised all the work which had been done and drew out some of the key results and impacts.

Although a cost-benefit analysis (CBA) of any policy or program proposal is preferable, such an analysis was not done. The Office of Best Practice Regulation, who received the regulatory impact statement, recommended that a CBA was not practicable for the Plan, and CIE [35] provided an overview of the different challenges and issues associated with attempting to do a CBA. Table 4 (adapted from information in MDBA [40]) provides a summary of some of the benefits and costs that were considered by the MDBA.

Table 4: Summary of the Benefits and Costs considered by the MDBA

Table 4 highlights the many identified benefits of the Basin Plan, namely: a) strategic coordination benefits (outlined further below); b) environmental benefits; c) water use values, and d) water non-use values. Of course, these categories all overlap, and not all of them could be properly quantified. There was no specific economic environmental valuation done for the Basin Plan, instead the calculation of non-use values relied upon existing literature and benefits transfer (e.g. [49]), likewise for the calculation of ecosystem services [45]. Water use benefits that were quantified from a 2,800 GL/pa reallocation to the environment included: tourism benefits; floodplain agriculture; recreational and commercial fishing; recreational boating; avoided costs—salinity; reduced risk of blackwater events; reduced risk of cyanobacterial blooms; reduced risk of acid sulphate soils; and reduced risk of river bank collapse.

Tourism benefits (AUD$162 million annually) were easily the largest use benefit that will increase as a result of increased water reallocation to the environment, followed by reduced risk of river bank collapse (AUD$24 million annually). The cultural, spiritual and environmental benefits associated with a healthier Basin (otherwise known as non-use benefits of the Plan) were easily the largest category of benefit; estimated to be anywhere from AUD$3-8 billion in total. Caution was advised in any interpretation of the results, due to the possibility of double-counting, and it was recommended that a future program of economic valuation research be undertaken, specifically for non-use values and a more comprehensive study of Aboriginal values in the Basin [45]. Given the diversity and size of these benefits, most studies have concluded that they seem to outweigh the costs (e.g. [42]), although it should be noted that in the end, there was very little reliance given to non-use values in the regulatory impact statement, potentially because of the uncertainty surrounding the values.

Given the difficulty of estimating benefits from the Basin plan, one may think that it an estimation of the costs involved would be more straightforward. Indeed, a number of economists (as highlighted previously) have developed extensive models to estimate the impact on Australia's economy from reallocating water from consumptive to environmental use. Economic modelling can provide a wide variety of estimates, such as changes in gross value of irrigated production, gross value of agricultural production, agricultural profit, gross regional production, gross domestic production, household consumption and employment. It is easy for various groups and media to use larger figures from changes in gross value of irrigation production rather than agricultural profit, hence placing more political pressure on politicians and water managers. Table 4 highlights two measures of economic costs (loss of regional agricultural production and loss of agricultural profit.

The other problem with economic modelling is that it is based on a variety of assumptions. Although it is predicted that a reallocation of water will reduce agricultural profit in the Basin, other estimates based on actual farm economics show otherwise. For example, based on thousands of actual farm surveys in the Basin, Wheeler et al [53] and [54] found that there was no to only very weak significant evidence that farms who sold water entitlements to the Commonwealth ended up reducing their current or future agricultural profit. One of the reasons for this (which is not taken into consideration in economic models) is that many farms own surplus and buffer water, and with other careful farm adaptation measures adopted, many did not decrease agricultural production at all after selling water [33,54].

Nevertheless, given the range of benefits and costs provided in Table 5, this paper provides a heuristic assessment (note: this author agrees that a full CBA was not possible given existing information) of the net benefits for the 2,800 GL/pa reallocation. Ignoring non-use values and only assessing use values and costs (two different estimates of the loss of agricultural profit and administration costs), this provides a range of benefit to cost ratio of 0.9 to 1.1. Including all non-use values the ratio ranges from 2.4 to 3.0. Given the huge uncertainty around the non-use values, at the very least it seems highly likely that they are large enough to indicate there are net social benefits from the Basin plan.

Although a CBA was not conducted by the MDBA, there was consideration given to the ‘without plan’ scenario, versus the ‘with plan’ scenario. This is shown below in Table 5 [40; pp. 33-34]. It reveals that there were many additional benefits of the Plan that were not quantified (and were not quantified in this paper’s heuristic assessment), specifically, the improved water market trading rules, which would increase the flexibility and adaptation of irrigators in the MDB. Previous discussion has highlighted that water markets allowed many farmers to survive the drought, which they may not have done otherwise. Such adaptation benefits are difficult to measure, although various economic studies (e.g. [25,27,52]) have signalled the large economic benefit to be gained from having water markets in place.

Table 5: Key strategic coordination benefits of the Basin Plan

Therefore, the Basin Plan provides a significant opportunity for improving environmental sustainability; water allocation; water markets, and operations and integration across state borders in the MDB. As such, it is hoped that the Basin is on a path to sustainable water extraction, as evidenced in Figure 3. Nevertheless, it was recognised that there are a number of small rural communities that will suffer relatively more from water reallocation than other areas (see [40] for many illustrations of figures that attempt to show the disparity of regional impacts of water reallocation). Small MDB communities that are dependent on irrigation are the ones most at risk to water entitlement sales. Less dependence on irrigated agriculture makes towns more adaptable and reduces their vulnerability. Up to ten districts in the MDB have been identified as having a particularly low adaptive capacity index [27].

6. Further discussion on water reform in the MDB

One of the main lessons **(Lesson Two)** from this paper is that there is considerable path dependency in water policy. It took a century from the very first transboundary water policy reform, the 1915 River Murray Waters Agreement, to the highly comprehensive and detailed 2012 Basin Plan, and there were numerous reforms undertaken by the Commonwealth within this time period (**Lesson Six**). Many benefits attributed to the Basin Plan can also be attributed to the first water agreement, and the subsequent reforms. For example, the development of water markets, and the unbundling of water from land, from the 1980s onwards, has allowed for the voluntary acquisition of water rights from irrigators; this may not have happened otherwise. Figure 3 also highlights how droughts have usually been the trigger for significant water policy reform, signalling that out of a crisis new opportunities for cooperation and agreement arise **(Lesson One).**

The conflict over the Basin Plan in Australia highlights the trade-off that is associated with water reallocation; there are winners and losers, and benefits and costs. Australia is a relatively wealthy country, and governments have made the choice that, generally, irrigators' rights to water are paramount. This has meant that irrigators have total rights over their water, whether they use it or not. For instance, sleeper and dozer rights were recognised when the Cap was introduced in the 1990s and irrigators who had never (or rarely) used their water could sell their rights on the market (see Young [55] for more comment). The buy-back of water, starting in the 2000s, continued this recognition. Generally all water was treated as voluntary acquisition, prices above the market were paid, and surplus water has been bought back [33].

To appease rural communities, billions of dollars have been directed towards irrigation infrastructure upgrades. There are supposed water recovery benefits that will result from this, though due to issues such as reflows and increasing water use efficiency, many suggest that the actual recovery benefits from infrastructure upgrades will be minimal [35]. Although the Basin Plan has been signed into law, the states all took their time in signing up. The Commonwealth originally put AUD$1.7 billion on the table to encourage states to sign up, but only Victoria, ACT and SA officially signed in the months following the adoption of the Plan. In particular, the state that has complained the most about the Basin Plan (namely NSW), argued that there is not enough money available, but by missing the June 30 2013 deadline to sign the plan, NSW (and Queensland) missed out on 2012-13 round of federal funding offered to implement the plan [56]. On February 27 2014, NSW and Queensland signed the Intergovernmental Agreement on Implementing Water Reform in the Murray-Darling Basin and an amended National Partnership Agreement. In order to achieve this agreement, the Commonwealth agreed to cap water purchases at 1500 GL and prioritised water infrastructure programs, and offered AUD$80 million for NSW irrigation programs. AUD$97.5 million was also offered to the states from the Commonwealth through the Regional Economic Diversification Program [57]. The consequences of this reorientation of priorities will be less water reallocated for the environment.

The role of the downstream state, SA, in playing a leading agitator role in highlighting the need for greater water reallocation should also be noted. It seems that there needs to be a strong agitator in any transboundary water conflict to lead the way for change and cooperation **(Lesson Seven).** SA has taken this role time and time again. For example, being the first in 1969 to place a moratorium on the issue of new water entitlements, and it was the first state to develop markets for the formal transfer of water entitlement and allocations in 1983. However, as an agitator state it must be careful not to be inconsistent with its policy demands, otherwise its credibility risks being eroded.

The compensation put on the table by the Commonwealth to encourage the development of a transboundary agreement might only be an option available to wealthier countries. However, it does signal the need for countries that will be made worse-off from sharing their water resources, to develop a plan/make a case for compensation. But, it should also be recognised that these countries may often over-state their case for compensation. The MDB example has highlighted the difficulty of estimating benefits and costs from water reallocation, as well as highlighting that a considerable amount of money was spent inefficiently on consultation and consultancies, many of which were of dubious quality. In order to estimate benefits and costs of water reallocation, it is perhaps better to focus on a smaller number of high quality studies, and to give those studies enough time to analyse the impacts of water reallocation. It is also important to note that high-quality socio-economic research can take as long as scientific research. The other main lessons from the MDB example is that before having transboundary water agreements in place, there needs to be a very good understanding of hydrological considerations; the link between surface water use and groundwater use; sustainable use and environmental needs, and institutions must be in place to enforce monitoring and compliance [4]. This brings us to:

Lesson Eight: Effective water policy needs high quality environmental, hydrological and socio-economic information, and preference should be given to long-term research rather than short-term consultancy.

There are also lessons to be drawn from the extensive consultation that was undertaken with vested interests. As **Lesson Four** suggested, it is very important to consult widely and keep communication lines open. However, there are questions regarding the extent and type of consultation. Obtaining the views of irrigators towards water reform issues from representative irrigator surveys reveal a very different picture than the one presented by their lobby groups or popular media outlets [35]. This confirms the important of undertaken representative, wide consultation in the first place, to lessen the probability of vested or political interests interfering with, or changing, water reform. The cost of this interference was the additional money directed towards irrigation infrastructure upgrades, and that it was easy to ignore the hydrological realities of reflows or the use characteristics of entitlements. Young [58] advises of the need to design policy instruments with hydrological integrity and to ensure robustness of a system through proper accounting of water use.

There are many issues still associated with the level of water recovery planned under the Basin Plan. **Lesson Five** highlighted that it is possible that no plan can ever reach a 'sustainable extraction point'. Apart from issues associated with irrigation infrastructure recovery and actual environmental need, issues that this author believes will need considering further in the future include the long term average annual yield attributable to each water security; climate change impacts; increasing utilisation of irrigation water owned; and groundwater substitution for surface water irrigation. A combination of these factors may illustrate that the actual reality of water bought by the Commonwealth in the MDB is significantly less than the estimates currently suggest.

Finally, institutions must be flexible, and plans adaptable, because they will never be perfect nor represent true environmental needs. Flexibility is essential, because it will aid adaptation in a new era of climate change. This brings us back to **Lesson Three**: the importance of adaptation. Water policy should always seek to support adaptation from irrigators, and not stifle such adaptation. One of the main private benefits of water reform in the MDB, namely increased adaptation from the use of more efficient water markets, was a value not considered in the overall review of benefits and costs.

The institutional analysis of water policy in the MDB indicates four levels: 1) embeddedness; 2) environment; 3) governance; and 4) resource allocation and employment. The aim is to seek institutional change in levels 1) to 3). Past water reform has made a significant inroad to embedding the property rights of environment in water allocation in the MDB. Future water policy will need to concentrate on further embedding the importance of the environment, as well as to start to recognise the cultural importance of water to indigenous groups. Other various governance issues surrounding water markets include: reducing barriers to inter-regional trade; investigating and seeking to reduce transaction costs in the market; developing new water market products such as forward contracts, options and water donations, urban water markets; improve water price, climate, commodity forecasts and allocation information; investigate market-based instruments (e.g. carbon credits) to increase farmers' adaptive capacity to climate change and reduced water, and further investigate the relationship between irrigation infrastructure investment and reflows, and between increased groundwater use and surface water trade [4].

Finally, there remains an overarching need to reduce water policy trans-boundary conflicts, and reform Level Two institutions. Currently a variety of state and federal governments have responsibilities for water policy, and there may be benefits to be gained from an evolution of responsibility towards one key institution such as the Murray-Darling Basin Authority. However, this study has highlighted the considerable pace of water reform policy in the MDB. In an era of full water allocations over the past couple of years, it is obvious that many policy makers, water managers; irrigators (and indeed researchers!) are in a period of fatigue. History shows that it will only be another severe drought that will drive through a further period of significant water reform.

7. Conclusion

There is a growing need across the world to establish (and consolidate) transboundary water agreements. One of the difficulties faced with such agreements is the need for countries/regions to understand the benefits from signing such agreements, and for such agreements to include a plan for compensation for areas that will suffer net costs. The MDB in Australia provides a leading example of a region that has attempted to coordinate agreements over different states and time-periods. There has been a century of transboundary reform in the region, culminating in the latest 2012 Basin Plan. This will not be the last plan developed in Australia, or its final institutional change; issues related to groundwater; climate change; long-term average annual yields, and true environmental needs will need consideration in the near future. The Basin Plan has been one of the most costly exercises ever undertaken in Australian history because of its large-scale consultation, and in its estimation of the benefits and costs of various water reallocation scenarios. This produced a variety of estimates, some high quality, many not. Overall, analysis in this paper signals that the quantified benefits of the Plan seem to outweigh the costs by up to three times, although there were a number of regional areas that may be at risk from implementation of the Plan. As such, significant funds have been allocated by the Commonwealth to compensate losers, as well as to encourage the various states to sign up to the Plan. In doing so, original water reallocation goals were downgraded. Such an expensive compensation path may not be feasible for many other international countries. Although Australia is on a path to sustainable water extraction, it is important to note that it is not there yet, and that policy and institutions need to continue to be flexible enough to allow further adaptation and innovation. There is also the need for robust argument and for the true identification of benefits and costs to be highlighted by policy makers. The ongoing challenge of climate change and water scarcity management means that there needs to be continuing adjustments to water policy, as well institutional and governance arrangements.

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FIGURE CAPTIONS (Figures supplied in separate file)

Figure 1 The MDB with major irrigation districts

Figure 2: Murray-Darling Basin flows 1890–2000s.

Figure 3 Progress towards a full transboundary agreement in the MDB, 1915 to 2012

Figure 4: State Conflict over River Murray Water

Figure 5: Surface Water Trade Areas in Australia.

Figure 6: Water trade in the southern MDB

Table 1: Water Institutions in Australia

Level	Institution Type	Relevant Theory	Australian Water examples
One	Embeddedness: *Informal institutions, norms, cultures, religion*	Social theory	Dreams of taming the rivers, greening the desert, and making land productive, are ever present in Australia for many years
Two	Environment: *formal rules of the game, with respect to property, judiciary, policy, bureaucracy*	Economics of property rights, positive political theory	*Irrigation Act 1886* (VIC) *Water Act 1912* (NSW) *River Murray Waters Agreement* (1915) *Water Act 1926* (Qld) *MDB Basin Act* (1993) COAG (1994) Unbundling of water from land *Water Act 2007* (Cwlth)
Three	Governance: *play of the game, contracts (aligning structures with transaction costs)*	Transaction costs	River Murray Commission (1917) National Water Initiative (2004) Murray-Darling Basin Authority (2007)
Four	Resource Allocation and Employment *(prices, incentives, quantities)*	Neoclassical economics, agency theory	Water market trade Carryover Flows between states

Table 2: Australian entitlement and allocation trade volumes (GL) in 2011-12

	Water entitlements	Water allocations
MDB regulated	1,065	4,127
MDB unregulated and groundwater	153	89
Other water systems	218	81
Australia total	1,437	4,297

Table 3: Overview of Key Water Trade Studies Conducted in the MDB

Study	Methodology	Detail	Estimated Value $ AUD
[28]	Computable general equilibrium (CGE) model analysis of the Impacts of reductions of 10, 20 and 30% in water availability in the sMDB under conditions of no trade, intra-regional trade only, and both intra- and interregional trade	The model estimates that moving from no trade to intra- and interregional trade together more than halves the impact of the reductions in water on the gross regional product in sMDB, and moving from no trade to intra-regional trade lessens the impact by 35 to 42%. Including interregional trade reduces it another 22 to 24%. Modelled value of trade from 1997-98 to 2001-02.	$1.4 billion
[52]	Irrigation water demand optimisation model	1) Reduction in water market barriers in the sMDB would increase annual net returns significantly 2) Expanding from intraregional trade to interregional trade	$17 million $88 million
[29]	CGE model was used to estimate the aggregate economic impacts of water trading at the regional, state, sMDB and national levels	Found water trading in the sMDB increased Australia's gross domestic product in 2008–09	$220 million
[30]	Partial equilibrium model	Assessed allowing water trade interregions with reallocation of water from consumptive to environment in the MDB allowed increased gross value of production	$91 million
[31]	Hydro-economic model	Results show with no inter-regional water trade the present value of reduced net profits in the Basin is much less under a reallocation of 3000 GL/year to increased environmental flows	$3.9 billion
[51]	Comparative static partial equilibrium model	Simulates water trading both within and between MDB regions, using census data from 2000-01 and 2005-06. Estimated a range of scenarios of water reallocation, before and after interregional trade. For example, Scenario 2 assessed 2800 GL SDL with Cwlth investment in Infrastructure, with and without trade.	$142.3 million
[32]	CGE model - Modelled without access to water trade in the sMDB. CGE - Modelled expanded intra-and inter regional trade as a consequence of National Water Initiative reforms in the sMDB.	1) Examines aggregate economic effects of water trade on irrigator water adjustment within and across irrigation regions from 2006/07 to 2010/11. 2) NWI institutional reforms were estimated to have reduced the impact of drought within the sMDB from $11.7 billion to $7 billion over the 2006/07 to 2010/11 period—with higher magnitude benefits being incurred during exceptionally dry years when the need to reallocate water was highest	$4.3 billion $4.7 billion

Table 4: Summary of the Benefits and Costs considered for the Basin Plan

Category of benefit	Source	Unit(s)	Expected benefit, by water recovery scenario		
			2,400 GL/y	2,800 GL/y	3,200 GL/y
Strategic coordination benefits					
Improved management of Basin water resources		qualitative	Will ensure that the full benefits of moving to SDLs are maximised. Benefits include those to water resource planning, environmental watering, water quality and salinity management and water trading. In addition, increased certainty will benefit business and communities. The benefits are not expected to change materially in the context of different SDL options.		
Environmental indicators					
Improved flow regimes	MDBA hydrological analysis [36,37]	frequency of meeting defined flow indicators	Would generally not achieve specified environmental objectives.	Enhanced capacity to mitigate periods of potential extreme environmental stress during extended dry periods. If key constraints in the system are relaxed, there is an improvement in peak and frequency of high flow events.	
Anticipated environmental benefits at hydrologic indicator sites	Authority hydrological analysis [36,37]	qualitative	Reduced benefits relative to 2,800 GL/y scenario.	Some benefits. If system constraints are relaxed, there is an overall improvement in peak and frequency of high flow events, but not enough to reach any more indicator targets.	With existing system constraints, increased benefits relative to 2,800 GL/y scenario, but only to a limited extent. If system constraints are relaxed, improved environmental outcomes could be achieved.
Estimated changes in ecological condition	[36,37,38]	% change in condition	-	Some positive outcomes, but only partial indicators of overall ecological benefits across the Basin was assessed.	-
Use values (Estimated annual benefit AUD$m/per annum)					
Tourism benefits	[38]	Increase in tourism expenditure, $m/y	-	162	-
Floodplain agriculture	[39]	Incremental economic value, $m/y	-	65 (Present value total)	-
Recreational and commercial fishing	[40]	Increase in consumer and producer surplus, $m/y	-	9.3	-
Recreational boating	[41]	Increase in total surplus, $m/y	-	42 (Present value total)	-
Avoided costs—salinity	[38]	Avoided cost, $m/y	-	10	-

Reduced risk of blackwater events	[38]	Recreational benefits, $m/y	-	5 -10	-
Reduced risk of cyanobacterial blooms	[38]	Recreational benefit, $m/y	-	5-11	-
Reduced risk of acid sulphate soils	[38]	Avoided cost ($m/y)	-	9	-
Reduced risk of river bank collapse	[38]	Avoided cost, $m/y	-	24	-
Non-use values					
Cultural, spiritual and environmental benefits associated with healthier Basin	[42,43,35,38]	Indicative estimates, $m	3,000 to 8,000 (PV total)		
ECONOMIC COSTS					
Category of cost	**Source**	**Unit(s)**	**Water recovery scenario**		
			2,400 GL/y	**2,800 GL/y**	**3,200 GL/y**
Forgone gross regional production in Basin	[44]	$m/y	-$443m/pa (-1.3%)	-$513m/pa (-1.5%)	-$585m/pa (-1.7%)
Foregone agricultural profit	[44]	$m/y		-$109 to -160m/pa (-5.6 to -8.2%)	
Commonwealth administrative costs	Information from Commonwealth agencies	Qualitative assessment and indicative estimate, $m/y	The Authority has estimated the net additional administrative costs for the Commonwealth, Basin States, and irrigation infrastructure operators to be in the order of $100 million per year.		
States administrative costs	MDBA analysis of data provided by States				
Irrigation infrastructure operators administrative costs	Communication with operators and MDBA analysis				

968 **Table 5: Key strategic coordination benefits of the Basin Plan**

Element of water management	Without Basin Plan	With Basin Plan
Clear objectives and outcomes for Basin water management	Basin water resources are managed through five State/Territory jurisdictions. Management objectives and outcomes are not integrated or coordinated across the Basin.	Clear and coordinated Basin-wide objectives and outcomes will help ensure that Basin water resources are used in a way that optimises economic, social and environmental outcomes.
Overuse of Basin water resources	Many systems are still overused. There is no consistent recognition of overuse.	Clear limits set on volume of water that can be taken on a sustainable basis from the Basin's water resources.
Water resource planning	Water plans are inconsistently implemented across the Basin. They do not provide an adequate framework for addressing overuse of Basin water resources. Approaches to objective setting, monitoring and reporting are weak in many cases. Plans have not adequately coped with extreme events (e.g. see NWC [17]).	Water resource plans will be implemented consistently across the Basin, and will be required to cover essential matters including: long-term diversion limits; environmental water requirements; planning for environmental watering; interception management; water quality management; water trading; addressing risks to water resources, and extreme events.
Environmental watering	Management of environmental water is inconsistent across the Basin. Opportunities to improve overall outcomes from coordination across connected systems are not taken.	Safeguards existing environmental water, plans for the recovery of additional water, and sets out arrangements to coordinate the use of environmental water throughout the Basin.
Water quality and salinity management	While much previous work has been done in relation to water quality in specific catchments, there is a need for a Basin-wide framework.	A water quality and salinity management plan sets science-based water quality objectives and targets, and provides a framework for the monitoring of progress towards their achievement.
Water trading	While a range of rules already exist at the state and local level governing water trade within the Basin, these rules are not consistent or comprehensive. Trade barriers remain, even with NWI commitments to facilitate water markets.	The Basin Plan provides a framework for consistent and comprehensive water trading rules. This will ensure that all market participants have the same rights and are confident of their rights, regardless of where they are trading, and it will help facilitate the movement of water to its highest value uses. The trading rules complement the water charge and water market rules, and the role of the Australian Competition and Consumer Commission (ACCC), under the Water Act.

Certainty for irrigation businesses and communities	Existing water management regimes are not able to cope with extreme conditions—for example, during the recent drought many water sharing plans were suspended.	Irrigation businesses and communities will benefit from increased certainty about the availability of water, and the rules governing its availability. They will be able to make planning and investment decisions with more confidence that governments are managing and allocating water on a sustainable basis. This will reduce risk and encourage investment. By ensuring that water resource plans meet specified requirements, and are made in the context of sustainable diversion limits on water that can be taken for consumptive use, the Basin Plan will ensure security and reliability of water rights.