8-28-2015

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William L. Andreen
University of Alabama - School of Law, wandreen@law.ua.edu

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WATER RESOURCES PLANNING AND MANAGEMENT
R. Quentin Grafton & Karen Hussey, eds.
(Cambridge Univ. Press 2011)

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Edited by

R. QUENTIN GRAFTON
The Australian National University, Canberra

KAREN HUSSEY
The Australian National University, Canberra

CAMBRIDGE
UNIVERSITY PRESS

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WILLIAM L. ANDREEN

8.1 Introduction

Domestic water law regimes all around the globe face a common challenge: how to allocate freshwater resources in a fair, efficient, and sustainable manner. Agriculture, industry, and municipalities have traditionally competed for this increasingly limited resource. The legal structures that were devised to meet those critical economic and social uses, however, ignored another use, a non-consumptive use that until recently was not well understood and had relatively few champions in the political or legal arena. The environment – including adequate stream flows and healthy ecological processes – is the use that our domestic water law regimes have typically overlooked; the reason is that these legal systems were designed, in large measure, to regard water as a commodity for exclusive human use and consumption.

As a result of this myopic approach to the use of a natural resource, many rivers and streams bear little resemblance today to the waters they once were. Agricultural interests, industry, municipalities and other water managers have manipulated and degraded our freshwater resources in relentless fashion, all facilitated by domestic water law regimes. Meanwhile, little or no attention was paid to the adverse environmental effect of reduced stream flows or to the value of the ecological services that well-functioning freshwater systems provide.

After so many years and the creation of so many economic and social expectations predicated upon prior practice, change is difficult. Many waters are over-appropriated or otherwise impaired by excessive or unwise water uses. The injection of a new use at this late stage threatens many powerful economic entities and persons. The bias that favors human needs and economic development over the environment is strong and may grow more intense as climate change reduces the availability of freshwater in many places. Nevertheless, a number of legal systems around the world have attempted, to one degree or another, to integrate environmental concerns into their legal regimes for allocating water. This chapter explores the way in which three nations have done so: the United States, South Africa and Australia. It also examines the failure of a pure market approach

Water Resources Planning and Management, eds. R. Quentin Grafton and Karen Hussey. Published by Cambridge University Press.

in Chile, which made water into a complete commodity to the exclusion of ecological considerations.

Regardless of whether a nation's approach has been predicated upon some reform around the edges of an existing property law regime, as in the United States, or more ambitious reform, as undertaken in South Africa and Australia, four challenges remain. First, will there be sufficient political will to create adequate environmental shares, even when that means that allocations for various consumptive uses will have to be significantly reduced? Second, will these governments have the will and wisdom to provide the kind of sophisticated scientific and technical assistance that will be necessary to set stream flows (both in terms of amounts and timing) which have to be provided in order to maintain water quality and promote a healthy level of biodiversity? Third, will these governments recognise the need for precaution, understanding that environmental flows will initially be established with some scientific uncertainty (a fact that should call for the establishment of a margin of safety)? Fourth, will these governments have the foresight to understand that stream allocation decisions are, by necessity, a work in progress, and that additional adaptive decisions will have to be made – to help fine-tune the balance between nature and human uses – as more data becomes available?

8.2 Muddling along: the American experience

Water law in the United States is dependent upon geography. In the East, where water is relatively plentiful, a doctrine of riparian rights developed. Under this approach, water is treated as a form of common property. All riparian owners have a right to reasonable use of the resource, and, in the absence of judicial involvement, all riparians have a right to exercise their own judgement about how much water they use and how they use it (Dellapenna, 2002). However, about half of the eastern riparian rights states have created a kind of hybrid system under which permits are granted for large-scale water withdrawals (Tarlock, 2005). In the more arid West, the eastern riparian doctrine was rejected in favour of an approach that treats water as a form of private property. People were permitted to appropriate water on a first-come, first-served basis under a doctrine that became known as prior appropriation (Getches, 1997).

The riparian rights system developed along the eastern seaboard in the early years of the nineteenth century. It replaced a natural flow rule that had held that each riparian landowner had the right to use a stream in its natural condition without artificial interference. This rule, while serving the needs of an earlier day, impeded the growth of the new republic's economy, powered as it was in so many cases by the use of mill dams to manufacture textiles, saw timber, and produce other goods (Horwitz, 1992). The new doctrine provided that a riparian owner could make reasonable use of water as long as it did not interfere with reasonable use by downstream owners (Horwitz, 1992).[1] Although the doctrine originally limited water use to those whose land abutted a stream, the common law today often allows non-riparian use and sometimes

even non-watershed use if the transfer produces no substantial harm to other riparians (Tarlock, 2005: 73–75).

This approach suffers from a lack of specificity over the amount of water that one can legally use. More specificity can be provided by water rights litigation, but such litigation is fraught with uncertainty due to the vague nature of the balancing test used to define reasonable use. In addition, any allocations are subject to judicial reallocation when new users enter the watershed (Dellapenna, 2002). According to the Restatement (Second) of Torts, the factors that apply in making judicial allocations include: (1) the purpose of the uses; (2) the suitability of the uses to the water in question; (3) the economic value of the uses; (4) the social value of the uses; (5) the harm the defendant's use causes; (6) the practicality of avoiding or minimising harm by adjusting the defendant's use; (7) the practicality of adjusting the amount of water each riparian uses; (8) the protection of existing uses and investments; and (9) the justice of placing the loss upon the defendant (Restatement (Second) of Torts 1979).[2] Conspicuously absent is any reference to environmental concerns or to the maintenance of a sustainable aquatic ecosystem.

The riparian doctrine made little sense, however, when, owing to population growth and increases in per capita consumption, there was too little water to go around. Therefore, in about half the riparian rights states, statutes have replaced the vague notions of the common law with more precise regulatory formulations. Unfortunately, the regulatory systems in most of these states are not comprehensive. The systems, instead, generally require (1) the submission of information about withdrawals; (2) permits for large withdrawals; and (3) an explanation of the impacts associated with watershed transfers (Tarlock, 2005). In issuing permits for large withdrawals, the state regulatory agencies make a determination of reasonable use based on social policy and the impact of the allocation on other water users (Beck, 2007). These state statutes also often require the agencies to establish some sort of minimum environmental flow.[3] In many states, the agencies can revisit the issue of reasonable use when the permits expire. A number of states, however, exempt certain classes of water users from the permit requirement because of the political might wielded by particular users or because the legislatures feared the consequences of possible takings litigation (Dellapenna, 2002: 35–37).

The Americans who settled the dry lands west of the 100th meridian (running from North Dakota to Texas) did not believe that their needs could be satisfied by the riparian rights doctrine. Their farms, ranches, and mines were often located miles from streams, and there was seldom enough water to satisfy all possible comers (Getches, 1997).[4] Westerners, therefore, detached water rights from riparian ownership, and rights to fixed quantities of water were based upon beneficial use and seniority (first in time, first in right) rather than need, utility or reasonableness (Tarlock, 2005). Thus, in times of scarcity, senior appropriators may not lose a drop of water, whereas junior ones lose everything (Craig, 2008).

This prior appropriation approach commodified water. As such, it could be sold or transferred by appropriators just like private property, although, in most instances, the states allocated the water to these private parties free of charge. While the concept of beneficial use included a rule against waste, the rule has only occasionally been enforced due to

difficulties of both detection and definition. The state agencies that administer this system also had statutory authority to deny allocation permits that violate the public interest, but in most cases they simply authorised all appropriations (Wilkinson, 1992).[5]

Prior appropriation, as a result, is much more destructive to the aquatic environment than eastern riparianism since it lacks any impetus for leaving water in a stream (Craig, 2008). On account of its 'first in time, first in right' principle, the doctrine spurred people to divert as much water as possible as quickly as possible, often encouraging inefficient practices. Senior users, moreover, have little reason to conserve since they often lose nothing during periods of low flow (Dellapenna, 2002).

Some western states like California and Washington have started to enforce the public interest requirement. New water permits in these states may be denied or conditioned in some way when a withdrawal could harm recreation or the environment. Most western states also have programs to protect instream flows for ecological purposes. While these programs have made a positive difference on some waters, these instream rights are generally junior, owing to later priority dates (Wilkinson, 1992). Consequently, on highly appropriated streams, minimum stream flows may have no actual utility during low flow conditions. Markets, moreover, have not played a large role in the western states. Although both conservation groups and government agencies have at times purchased senior rights and transferred them to instream flow programs (Katz, 2006),[6] the most heralded transfers – such as San Diego's 'purchase' of water from agricultural interests in the Imperial Valley – have been engineered by state governments and thus have not reflected the action of a true market. In short, fully functioning markets have not developed in the western United States because third-party rights, even those of a junior party, are protected in cases where a transaction would adversely affect those rights (Dellapenna, 2009a).

Three federal legal doctrines significantly affect the implementation of state water law. First, the federal common law of equitable apportionment applies to the division of interstate water resources among the relevant states, at least in the absence of an interstate compact or direct congressional action. In applying equitable apportionment, the US Supreme Court does not follow any strict formula and does not even necessarily apply the laws of the affected states. The Court, rather, tries to balance the equities presented by a particular case (Getches, 1997). Second, the federal public trust doctrine provides that the states may not sell or lease public land underlying navigable waters, thus protecting the public's right to use these waters for commerce and fishing, among other things (Craig, 2008).[7] Lastly, the doctrine of federal reserved rights seeks to ensure that Indian reservations and federal lands set aside for particular purposes, such as parkland, will have enough water to fulfill their purposes. These tribal lands and parks tend to have early priority dates in the western United States. As a result, these uses will often trump other water rights (Getches, 1997). Such reserved water rights, however, can only be established through an adjudication in a state court – not always an hospitable venue for the federal government, especially when it is difficult, in the first place, to quantify the amount of water encompassed by a reserve right (Jungreis, 2005).

A number of other federal statutes can affect the quantity of water that is left in a particular waterway. These statutes do not directly regulate the withdrawal and consumption of water, but rather deal with the use and value of water in situ.

The Clean Water Act (CWA) is the primary federal statute aimed at the control of water pollution (Andreen, 2004). It regulates point source discharges of pollutants to waters of the United States and generally applies uniform technology-based effluent limitations to these discharges.[8] If necessary, more stringent permit conditions are imposed to meet ambient-based, state water quality standards.[9] States are also encouraged to create programs to reduce non-point source pollution.[10] While the Act contains no specific provision pertaining to water quantity, it provides states with a tool that could be used in many instances to maintain adequate stream flows. Section 401 gives states the authority to certify (review, approve, veto, or condition) any federally permitted or licensed activity that may degrade water quality or the aquatic environment.[11] This authority extends to non-federally operated hydroelectric facilities (licensed by the Federal Energy Regulatory Commission), nuclear power plants (licensed by the Nuclear Regulatory Commission), various water projects (including activities that impair wetlands) which are permitted or undertaken by the US Army Corps of Engineers, and any CWA discharge permits issued by the US Environmental Protection Agency (EPA) (Andreen, 2006). Occasionally, this water quality certification power has been used by the states to stipulate minimum stream flows, but more often it goes unused (Andreen, 2009).[12]

The Endangered Species Act has, in some cases, figured highly in regulating various hydrologic modifications, including water releases from dams. The Act requires all federal agencies to ensure, in consultation with the US Fish and Wildlife Service, that no action funded, permitted, or carried out by them is likely to jeopardise the continued existence of any endangered or threatened species.[13] The Act also regulates private and state action by making it illegal to 'take' any such species,[14] a term which includes 'significant habitat modification where it actually kills or injures' a protected species.[15] Although the Act has not affected the way in which water is used on most waterways, it has led to recovery and management plans for a number of waters (Andreen, 2006) and has occasionally dictated the release of minimum amounts of water from federally operated dams (Andreen, 2008).

The construction and operation of private, state, and municipal hydroelectric facilities are regulated by the Federal Energy Regulatory Commission (FERC) under the Federal Power Act. Amendments enacted in 1986 require FERC to give equal consideration to 'fish and wildlife' and 'other aspects of environmental quality' as well as to power generation and development.[16] Although environmental considerations do not necessarily trump other concerns, a substantial examination of environmental impacts must be conducted.[17] Furthermore, each license issued by FERC must include conditions, based on recommendations from relevant federal and state agencies, to protect or enhance fish and wildlife resources affected by the project (unless FERC determines that they are inconsistent with the purposes of the Act).[18]

The construction of other dams, as well as other kinds of water-based development, located in waters of the United States is regulated by the US Army Corps of Engineers

under the Clean Water Act (Andreen and Jones, 2008). Under section 404 of the Act, all activities involving the placement or discharge of dredged or fill material in these waters must first obtain a permit from the Corps. Permits are issued pursuant to guidelines promulgated by EPA.[19] Permits must be denied if a project will result in significant degradation of the aquatic system.[20] And, in every case, appropriate and practicable mitigation is required as a precondition to the issuance of a permit.[21] EPA is authorised to veto Corps-issued permits if an activity will have 'an unacceptable adverse effect' on wildlife, fisheries, recreation, or municipal water supplies.[22]

US water law is not simple. The three principal approaches to allocation based on state law – riparian rights (a common property approach), regulated riparianism (a public property approach), and prior appropriation (a private property approach) (Dellapenna, 2009b) – closely interact with three federal doctrines: equitable appropriation of interstate waters, the public trust doctrine, and federal and Indian reserve rights. Some current state approaches include consideration of environmental flows, at least in many prior appropriation and regulated riparian states. Federal and Indian reserve rights and the public trust doctrine can also protect important ecological resources, as do many of the statutes that deal with water in situ such as state water quality certification under the Clean Water Act and the Endangered Species Act. The American approach, however, is highly fragmented, with no comprehensive approach to maintaining flows that sustain healthy aquatic systems. Too many gaps exist in both regulatory authority and in the data necessary to manage American waters in an environmentally sensitive and sustainable fashion (Doremus, 2005). The United States needs more detailed data about the relationship between flows and well-functioning ecosystems. It also needs institutional structures that will encourage the kind of informed cooperation and decision-making necessary to manage its watersheds in a more sustainable fashion (Andreen, 2006; Andreen and Jones, 2008).

8.3 A wrong turn: the Chilean free market experience

The use of markets to allocate increasingly scarce water resources was a concept that came to prominence in the latter half of the twentieth century. Free market advocates argued that private water rights and private bargaining among the holders of those rights would be the most efficient way to resolve allocation disputes and even environmental problems (Dellapenna, 2009a; Bauer, 1998). These advocates found a perfect vehicle for the institution of such a system when a military junta, headed by General Augusto Pinochet, overthrew the government in 1973. While the right-wing Pinochet regime did not act immediately to enact comprehensive water reform, when it did so the provisions of the 1981Water Code were consistent with the neo-liberal perspective of the government's economic team, commonly referred to as the 'los Chicago boys' due to their training in free market economics at the University of Chicago (Bauer, 1998).

The 1981 Water Code established transferable water use rights that were to be allocated by the government at no cost to the new owner (Williams and Carriger, 2006).[23] Applicants were not required to justify the quantity of water they requested and were not even required

to use it. The idea was that the market would create an opportunity cost for inadequately used rights which would eventually lead to the sale and more efficient utilisation of unused water rights (Pena, 2005).[24] Applications were to be granted as long as water was available. If sufficient water was not available to satisfy all pending applications, rights to the water were to be sold by auction to the highest bidder (Bauer, 1998).

In short, the Chilean system treated water as a commodity, which could be freely sold or leased just like any other kind of property – regardless, for the most part, of impacts upon third parties (Dellapenna, 2009a).[25] As a result, this approach did a poor job of both coordinating among multiple water uses and resolving conflicts between those users (OECD, 2005). The market, moreover, did not function as it was envisioned. There has been relatively little trading for a variety of reasons, including the fact that many owners opted to hoard their rights as a kind of insurance policy to guard against future droughts or to await higher prices, and, in some cases, to block competitors from entering the market (Bauer, 2004; Pena, 2005). Contrary to expectations that the market would encourage water conservation in order to sell the surplus, there has been little private investment in more efficient water technology (Bauer, 2004). The 1981 Code also had a negative impact on poorer farmers who generally lacked the legal and financial resources necessary to either acquire water rights or protect their interests (Bauer, 2004).[26] The environment suffered as well, since the 1981 Code did not provide for the consideration of instream flows in either the granting of original water rights or in their subsequent transfers (Bauer, 2004).[27]

In 2005, the Chilean government enacted a new water code to remedy the problems associated with the 1981 legislation. The new code requires allocation applications to explain how requested water will be used and to justify the amount of requested water by reference to project needs. In granting new water rights, the government is directed to consider the impact of the request upon minimum stream flows, and the President is empowered to set water aside from the allocation process when necessary to serve the public interest. Finally, in an attempt to limit speculation and hoarding, license fees will be charged for unused water (Pena, 2005).

As Chile has recognised, the 1981 free market approach to water management was deeply flawed. The government's ability to regulate the nation's water resources was slashed in favour of a pure laissez faire economic approach that privatised a free-flowing public resource. The result was a system in which there was little or no room to pursue environmental protection and a number of other important societal goals (Bauer, 2004: 134). The Chilean government, in other words, had completely ceded the public interest to the private market. It should come as no real surprise, then, that such a radical free market approach failed.

8.4 Changing priorities: the South African experience

Like northern and central regions in Chile and the western USA, South Africa is dry with an average rainfall of about 450 mm per year compared to a world average of 860 mm (Department of Water Affairs and Forestry, 2004).[28] The transformation of the South

African government in the 1990s gave rise to wide-ranging reform of water law. Unlike Chile in the 1970s, the transition in South Africa was to democratic rule. Also unlike Chile, the role of government in the management of water was not reduced to a position of relative insignificance in favour of a pure free market system. Instead, the national government in South Africa became the public trustee of the nation's water resources in order to 'ensure that water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner, for the benefit of all persons.[29]

Prior to the new democratically elected government, South African water law was based upon a form of regulated riparian rights, which gave water access to white landowners and largely denied access to the country's majority population, precluded as they were in most instances from owning land (Francis, 2005; Stein, 2005). The new law was designed to remedy that problem by providing more equitable access to water – part of an overall process for rectifying past discrimination in terms of land and natural resource distribution (Godden, 2005). In addition to providing a mechanism for social reform, the new law also envisioned a new approach to the environment, recognising that water should be managed in an ecologically sustainable way. Redress for past wrongs; redistribution of natural resources; and environmental protection – these are the three primary values animating the new South African water regime (Bronstein, 2002).

The National Water Act of 1998, therefore, has been widely viewed as one of the most progressive approaches to water management in the world – at least on paper (Francis, 2005). One reason for this view lies in the Act's structure, which purports to start the allocation of water from scratch. It does this by providing for 'a Reserve' – a Reserve of water which comprises the quantity and quality of water necessary to satisfy basic human needs and to protect aquatic ecosystems.[30] Only after providing for the Reserve and any applicable international obligations was water to become available for allocation to other uses. The Reserve, in short, is not an allocation, but the foundation from which all other allocations proceed. Only the Reserve is guaranteed as a right. Allocations made under prior law may well be cancelled at some point in the future, and even new allocations are not permanent, but rather are for a reasonable period of time (Department of Water Affairs and Forestry, 1997).[31] This approach, of course, raises questions regarding possible compensation for property infringement, but such claims are unlikely to succeed under either the new Constitution or the special compensation provision of the 1998 Act (Kidd, 2009).

South Africa appears to be starting all over again, endowed with a new-found sense of social obligation and an appreciation for the principles of environmental sustainability. Unfortunately, it is not so easy to turn the clock back. Many streams are already overallocated, leaving little room for environmental flows (Vuuren, 2009), and while it might well be theoretically possible to modify or extinguish some existing uses, economic reality will often dictate otherwise.

The government currently assumes that, as a national average, approximately 20% of river flow will be required to satisfy the ecological portion of the Reserve. This amount may vary considerably around the country, ranging from around 12% in the more arid regions to about 30% in the wetter areas of the southeast. These assumptions, however,

are based upon incomplete understandings of how these ecosystems work and what their habitat requirements are. Much work remains to be done (Department of Water Affairs and Forestry, 2004). Nevertheless, meeting any ecological flow requirement is going to be a very difficult task in many places because water deficits exist in more than half of the water management areas in the country (Department of Water Affairs and Forestry, 2004).[32] It is also clear that the first priority within the Reserve is the provision of basic needs, which is assumed to amount to 25 litres per day per person (Department of Water Affairs and Forestry, 1997).

The ecological component of the Reserve, therefore, cannot be met at current levels of use on many waters (Department of Water Affairs and Forestry, 2004). The Act anticipated this dilemma by requiring the establishment of a water resource classification system.[33] Different waters will receive different levels of protection and different Reserve levels depending upon their classification. The classes being considered are (1) Natural (little or no human impact); (2) Moderately Used/Impacted (slightly or moderately altered from natural conditions); and (3) Heavily Used/Impacted (significantly modified from natural conditions but still ecologically sustainable). Any water that is deemed to be unacceptably degraded would be classified as Heavily Used/Impacted and managed in such a way over time as to upgrade that classification (Department of Water Affairs and Forestry, 2004). Although severely degraded streams are supposed to be rehabilitated, this classification approach explicitly introduces economic concerns into the calculation of the ecological component of the Reserve. According to the National Water Resource Strategy, 'It is not possible for all resources throughout the country to be given a high level of protection without prejudicing social and economic development' (Department of Water Affairs and Forestry, 2004). Some balance is necessary. The crucial question, however, is to what extent are social and economic concerns going to trump the environment? The way in which the Reserves are finally calculated will reveal whether or not this entire statutory approach is primarily symbolic or whether it is a true reform effort.

The challenge lies largely in the way in which the program is implemented (Godden, 2005). The first step in this process involves the establishment of the Reserves. The Reserves, including ecological flow requirements, will be established at the national level.[34] This will be a complicated exercise since ecological flows should reflect both the natural hydrograph (seasonal variations) and the minimum flows necessary to maintain a healthy biophysical environment. Such determinations depend upon a thorough understanding of how aquatic ecosystems function and what their habitat requirements are. Before these flows are set, therefore, more monitoring must be done, more studies performed, and better assessment methods developed (Department of Water Affairs and Forestry, 2004).[35] Nevertheless, there will seldom, if ever, be enough data to set ecological flows that will not require subsequent fine-tuning. The South African government has itself recognised that an adaptive approach to water management is necessary since new monitoring and ecological data will indicate, from time to time, that revisions ought to be made to the initial management strategies (Department of Water Affairs and Forestry, 2004). The same kind of adaptive management approach should also apply to the initial flow determinations.

The actual implementation of ecological flows, however, will be an even more daunting exercise. This task will be carried out at the regional level by 19 separate catchment management agencies (Department of Water Affairs and Forestry, 2004). The job, if performed properly, involves the mastery of a complex hydrological web of ex situ water withdrawals and discharges, in situ releases from dams and weirs, and changing weather and climatic conditions. The job is so difficult that it would tax the capacity of a well-resourced agency. Unfortunately, these regional agencies are suffering serious shortages of both technical and administrative expertise (Godden, 2005; Vuuren, 2009).

During this implementation process, the political and social demands that will be placed on these catchment agencies will also be substantial (Bronstein, 2002).[36] The system for allocating water does not start from scratch. All existing appropriations will continue [37] until such time as those users are required to obtain a license.[38] If their appropriations are eventually reduced through the licensing process, the users may be entitled to compensation unless the reductions are necessary to satisfy the Reserve or to rectify an over-allocation from the waterway in question[39] – neither of which is an unlikely prospect given the water shortages that exist in more than half of the country's waters (Bronstein, 2002).[40] In either case, the user is not entitled to compensation.[41] Of course, sloppiness in monitoring and calculation could easily avoid the necessity of incurring the wrath that would certainly follow from such uncompensated cuts in existing appropriations. Applications for new licenses [42] and general authorisations (tantamount to a blanket license)[43] will complicate the situation even more.

While the remaining challenge is great, significant progress, nevertheless, has been made in South Africa. Broad socio-economic and environmental reform has been instituted in a remarkably short time. The ultimate test, however, is whether this reform will be symbolic only or whether it will actually be implemented in an effective way.

8.5 In search of sustainability: the Australian experience

Australia is also dry. In fact, it is the driest inhabited continent on earth with average annual rainfall of 469 mm (Gray, 2006). Like the western USA and much of Chile and South Africa, the largest consumptive use of water is for irrigated agriculture.[44] Unlike Chile and South Africa, however, Australia has a federal form of government. It shares this trait with the USA. and, like the USA, water law in Australia is based primarily on state law (Smith, 1999; Godden, 2005). Although the Australian colonies (states, after federation in 1901) originally applied the doctrine of riparian rights, they eventually moved to a more regulated system in recognition of the country's arid conditions (Fisher, 2006). In doing so, they explicitly rejected the prior appropriation system of the western USA in favor of a system in which the rights of the community were elevated above those of the individual (Smith, 1999).

During most of the twentieth century, Australians relied, not upon property rights, but upon government administration for the fair allocation of water (Connell, 2007). This

approach worked well for many years, since the interests of the government and water users were fairly well aligned. The government wanted to promote growth and development, and those who wanted to use water, primarily irrigators, were eager to expand their activities. There was little need to define allocations with great legal precision since there was generally enough water to go around. No one really worried about the environment (Connell, 2007)[45] amid numerous government schemes – including the Snowy River Hydroelectric Scheme (Ghassemi and White, 2007) – which increased water consumption through the construction of dams, weirs, diversions, and distribution systems (Smith, 1999; Connell, 2007). By the 1990s, many Australian waters were over-allocated, resulting in both intense competition among water users and a severely degraded aquatic environment (Gray, 2006). Ironically, the Australian reliance upon administrative management produced virtually the same result as the prior appropriation system did in the American West.[46]

Calls for reform came not only from the environmental community and those who realised that water use must be predicated upon a sustainable resource, but from water users who, amid shortages and over-allocation, desired security of entitlement (Godden, 2005). The Commonwealth, therefore, initiated a reform through the Council of Australian Governments.[47] The resulting agreement between the Commonwealth and the states set forth a number of guiding principles. For example, the state governments agreed to implement a system of water allocations backed by separation of water rights from land title and clear specifications of entitlements in terms of ownership, volume, and transferability (tradeable, in other words) (COAG, 1994). In addition, priority was to be given to the allocation of water to the environment, as a legitimate user, based upon the best scientific data available (COAG, 1994).

While some progress was made, it varied widely from jurisdiction to jurisdiction (McKay and Marsden, 2009). Progress was also slow. While state water law incorporated new processes to provide for and protect environmental flows, the actual implementation of sustainable environmental flows was spotty (Foerster, 2009; Gardner and Bowmer, 2008). In too many cases, consumptive rights continued to trump the environment. More dramatic change was necessary and, in June 2004, the Council of Australian Governments produced a new approach to reform – the National Water Initiative (NWI) (COAG, 2004) – which was agreed to by the Commonwealth and eventually by all the states (McKay and Marsden, 2009). The agreement was facilitated by the Commonwealth's commitment of A$2 billion, which is to be invested in water management activities by 2010 (McKay and Marsden, 2009).

The NWI is being implemented primarily through state legislation and, in the case of the Murray–Darling Basin, through the overarching operation of the Commonwealth's Water Act 2007.[48] The discussion here focuses mostly upon the policy framework established by the NWI.

The NWI is quite remarkable in terms of its breadth. Consumptive use of water will require a water access entitlement that is defined as a share of the consumptive pool of a water source. These entitlements will be determined pursuant to a water plan (COAG, 2004) and are fully tradeable (COAG, 2004). At the same time, the NWI specifies that

the states will meet 'agreed environmental and other public benefit outcomes as defined within the relevant water plans' (COAG, 2004).[49] A great deal, therefore, rides on the development of these water plans. The plans are required, broadly speaking, to secure these environmental and public benefit outcomes by defining appropriate management arrangements, while also determining shares in the consumptive pool (COAG, 2004) – presumably what is left once the environmental and public benefit share has been set. How much is set aside for the environment, however, is not entirely clear since the NWI states that water plans will involve 'trade-offs between competing outcomes for water systems [and] will involve judgments informed by best available science, socio-economic analysis and community input' (COAG, 2004). Without more precise definition, the environment could certainly wind up a big loser in the planning exercise – a problem aggravated by the fact that the NWI does not call for the use of a margin of safety in calculating the environmental shares. In addition, the drafters of the NWI apparently failed to understand that the creation and maintenance of environmentally sustainable flows often conflicts with recreational and navigation interests, which are defined as 'public benefit outcomes' (COAG, 2004) and included within the same shared pool. To compound these difficulties, the NWI seems to introduce even more discretion at the ministerial level by stating that the plans will merely 'assist governments and the community' in making water management and allocation decisions 'to meet productive, environmental and social objectives' (COAG, 2004).

At first blush, the provision for the marketing of water access entitlements would appear to stand as an obstruction to the maintenance of environmentally sustainable flows. After all, environmental flows must be maintained on all stream segments in order to protect the aquatic system. Marketing schemes, if unregulated, could produce damaging imbalances by authorising deals that affect different stream segments, thus jeopardising the continued maintenance of environmental flows all along a particular waterway.[50] The NWI marketing scheme, however, contains a prophylactic measure. Before a trade can result in a new water withdrawal, a regulatory approval must be obtained to enable water use at a new location (COAG, 2004). According to the NWI, that regulatory approval must be consistent with the relevant water plan and must take into account both environmental impacts and impacts on downstream third parties (COAG, 2004). Adherence to such an approach is absolutely necessary to preserve and protect environmental flows, but the process certainly makes water trading, if properly done, a complex and expensive operation.[51]

The entire enterprise, in fact, depends upon the generation of a great deal of scientific data about the impact of flows upon aquatic communities in terms of both the timing and volume of those flows (Doremus, 2008).[52] Only after that data has been obtained, or obtained in an initial way (since the NWI calls for adaptive management) (COAG, 2004), can the rest of the hydrological work be done to decide where and when withdrawals can be made. It is an incredibly ambitious undertaking, one that raises more than a little concern about the quality of its implementation.[53] For instance, will the ecological information be good enough to inform both the preparation of the water plans and subsequent government implementation Will there be adequate transparency when tradeoffs are made

between consumptive uses and environmental water, both during the preparation of the water plans and in subsequent government implementation (Gardner and Bowmer, 2008)? In the absence of either adequate data or adequate transparency, the environment could well lose out to forces favouring more robust economic activity.

Another problem also exists. What will be done in cases where a waterway is over-allocated? Will those entities whose entitlements are cut be compensated? The NWI provides that the states will make substantial progress by 2010 towards adjusting extractions on all over-allocated systems, while meeting environmental and other public benefit outcomes (COAG, 2004). If the revision of extraction schedules produces reductions in an entitlement holder's share, the NWI stipulates that the entitlement holder will bear the full cost, without compensation, during the implementation phase that ends in 2014. From 2014 onwards, such entitlement holders are entitled to compensation but only for reductions of over 3% (COAG, 2004). If adhered to, this risk-sharing formula could produce real political pain. And, depending on how pain-averse the states are, it could serve to lock in many existing allocations, and, if the allocations are too high, aquatic habitats may continue to decline (Connell, 2007).

The NWI provides that the states may opt for another risk-sharing formula (COAG, 2004), and the one for which they would most likely opt would involve compensation for reduced allocations (Connell, 2007). The states, however, would most likely look to the Commonwealth to fund such a programme. A model of sorts for this kind of approach can be seen in the Commonwealth's new 'Water for the Future' programme, a A$12.9 billion plan to restore the health of the Murray–Darling Basin and other places in the country where the Commonwealth 'holds' water to satisfy international agreements such as the Ramsar Convention on Wetlands and the Convention on Biodiversity (DEWHA, 2009).[54] Under this program, the Commonwealth has committed to investing A$5.1 billion over 10 years to modernise irrigation infrastructure, with a further A$3 billion to address over-allocation issues in the Murray–Darling Basin. The A$3 billion to address over-allocation will be divided between the acquisition from willing sellers of water entitlements for environmental flows and assistance to irrigators to exit the industry (ABARE, 2007).[55] The funds spent on environmental flows to date have been reserved for priority environmental assets such as wetlands of international importance and ecosystems with listed threatened species or migratory birds (Hyder Consulting, 2008), and indications are that this approach will continue for some time (DEWHA undated). Although prioritisation of this sort makes great sense at the beginning of the program, one wonders if the funds dedicated to the program will prove adequate to ensuring sustainable ecological flows throughout the entire basin. The initial purchases, moreover, have yielded little useable water for the environment since the entitlements that have been acquired were yielding small amounts of water (Hyder Consulting, 2008).[56] The programme, therefore, appears to be as much or more about assistance to the agricultural community in the Murray–Darling Basin as it is about the environment.

A precedent has been set, and expectations created across the entire country. So, in addition to all of the other complex problems facing the NWI, the attainment of adequate and

timely environmental flows will likely depend upon the acquisition of water entitlements in many, if not most, instances. Adequate funding, therefore, must be secured and made available for more than just the protection of certain environmental icons. If not, the much heralded promise of the NWI will not be fully realised.

8.6 Conclusion

Managing water amid increasing scarcity is a tremendous challenge. A balance must be found and maintained between water used to meet human needs and the needs of aquatic ecosystems. Finding that balance will not be easy. For hundreds of years, our water management regimes have paid scant heed to the needs of the environment, while constantly encouraging more and more human consumption. Such singular attention to anthropogenic concerns has created a crisis, a crisis of sustainability. The growth in water consumption and the endless manipulation of water have produced both serious environmental problems and concerns about the security of supply. Something must be done in order to sustain the resource base itself as well as provide for human needs. The task is complicated by the fact that the resource has in so many instances been overcommitted to human uses.

The Chilean experience illustrates well that the necessary balance cannot be achieved through sole reliance upon the operation of the market. The experience in the United States illustrates that the necessary balance cannot be achieved in the midst of an uncoordinated, fragmented regulatory system. Although efforts have been made to create and implement environmental flows and build more efficient infrastructure, the task is simply too vast, too complicated for such a hit-or-miss approach. A more integrated planning and implementation process must be created.

More progressive approaches to meeting this challenge may be found in South Africa and Australia. In both countries, efforts have been made to turn the clock back in order to create sustainable freshwater systems. The South African Reserve is intended to meet the needs for both distributive justice (meeting basic human needs) and ecological sustainability before allocating water to other human activities. In Australia, the National Water Initiative also appears to first set aside water to meet environmental as well as other public benefit needs before the remaining water is allocated among various users. In both cases, the symbolism is strong – national commitments have been made to effective, efficient, and environmentally sustainable water management. Policy objectives are one thing, however; implementation another.

The challenges facing both South Africa and Australia are considerable. Their efforts to reform water management will have to contend with market and political forces that will want to preserve the status quo ante and the generous water allocations that went with it. It will take prodigious political will to effect the promised change in the years to come, either through regulation, as in South Africa, or through a combination of regulation and entitlement purchases in Australia. The task, of course, is complicated because the implementation of these approaches requires prodigious amounts of data about both stream hydrology

and aquatic ecosystems, and a sophisticated understanding about the relationship between them. The friction produced by unhappy markets and political forces, the ambiguities contained in both legislation and policy statements, the level of transparency and discretion surrounding crucial allocation decisions, and the amount of resources and sophistication necessary to implement the programs – all may well cause the entire engine of progress to freeze in either or both countries. One hopes, of course, that progress is maintained and that both South Africa and Australia create models which the rest of the world will want to emulate.

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Endnotes

1. From approximately 1850, the English courts began to follow the American lead and emphasised a right to make 'reasonable use' of water (Getzler, 2006).
2. In most states applying the riparian rights doctrine, water use for domestic purposes, husbandry, and a small garden are not subject to the limitation of reasonableness (Getches 1997).
3. Florida, for example, requires local water districts to set minimum flows for all waters at the point at which further withdrawals could cause significant harm to the 'water resources or ecology of the area.' Florida Statutes Annotated §373.042(1)(b).
4. Most of the water used in the West goes to irrigated agriculture (Reisner, 1986).
5. Ten western states, including California, have complex systems that employ both appropriative and riparian rights in recognition of the fact that a riparian approach antedated the adoption of prior appropriation (Getches, 1997).
6. For example, between 1990 and 1997, some $61 million was spent to purchase water for environmental purposes in the western states (Katz, 2006).
7. Courts in two states, California and Hawaii, have held that vested water rights are subject to the public trust. *National Audubon Society v. Superior Court* 1983: 709 (the Mono Lake case); *In re Water Use Permit Applications for Interim Instream Flow Standard Amendments, and Petitions for Water Reservations for the Waiahole Ditch* 2000: 409.
8. 33 United States Code (USC) §§301, 402.
9. 33 United States Code (USC) §§301(b)(1)(C), 303.
10. 33 United States Code (USC) §1329.
11. 33 United States Code (USC) §1341.
12. Hydrologic modifications, including water withdrawals, channelisation projects, and dams, are the second leading cause of water quality impairment in the United States (Office of Water, US Environmental Protection Agency 2002).
13. 16 United States Code (USC) §1536(a)(2).

14. 16 United States Code (USC) §1538(a).
15. 50 Code of Federal Regulations (CFR) §17.3 (2009).
16. 16 United States Code (USC) §§797(e).
17. *California ex rel. State Water Resources Control Board v. Federal Energy Regulatory Commission (FERC)* 1992: 1541.
18. 16 United States Code (USC) §803(j)(1).
19. 33 United States Code (USC) §1344(a), (b).
20. 40 Code of Federal Regulations (CFR) §230.10(c).
21. 40 Code of Federal Regulations (CFR) §230.10(d).
22. 33 United States Code (USC) §1344(c).
23. Water rights were also separated, for the first time in Chilean history, from the ownership of land (Bauer 1998).
24. While water rights are supposed to be specified in terms of volumes per some unit of time, in practice they are often set forth as a percentage of available flow (Bauer, 1998).
25. Parties, of course, could try to bargain among themselves for protection and, should that prove unsuccessful, go to court (Bauer, 1998).
26. Approximately 1.2 million hectares of land are regularly irrigated in Chile and another 750 000 hectares are irrigated as supplies permit (Bauer, 1998). In general, irrigation accounts for 80% of freshwater consumption in the Andean region (Boelens, 2008).
27. The 1994 General Environmental Framework Law did refer to minimum environmental flows, and after 1994, the Chilean government broadly took minimum flows into account when allocating water rights (OECD, 2005). That was a tough task, however, since most water rights had already been allocated and regulatory power was nearly non-existent (Bauer, 2004).
28. Over 60% of water consumption is for irrigation (Department of Water Affairs and Forestry, 2004).
29. National Water Act, No. 36 of 1998, §3(1).
30. National Water Act, §§16–18.
31. The White Paper was approved by the South African Cabinet on 30 April 1997. The drafting of the National Water Act was based upon the White Paper (Salman and Bradlow, 2006).
32. In other words, in 10 of 19 catchment areas, so much water was being abstracted that either the ecosystem was placed under 'severe stress' or some users could not obtain their 'fair share' (Department of Water Affairs and Forestry, 2004).
33. National Water Act, §§12, 13, 16.
34. National Water Act, §16(1).
35. South Africa has pioneered the development of methodologies for determining environmental flows, but 'tying flows to the provision of specific ecosystem goods and services … is complicated' (Postel, 2008).
36. According to Bronstein, '[t]he bureaucratic allocation of licenses at the local level will inevitably fuel conflict in the countryside as historical rural struggles play themselves out' in the catchment management agencies (Bronstein, 2002).
37. National Water Act, §22(1)(a)(ii). Over 40 000 appropriations exist under prior law (Kidd, 2009).
38. National Water Act, §43
39. National Water Act, §22(7)
40. Bronstein expresses concern about the 'unpredictability and instability inherent in a discretionary licensing system' which is implemented at the local level (Bronstein, 2002).
41. The holder of a water right would also not be entitled to compensation if the cut-back was only to the level of holder's beneficial use (Kidd, 2009).
42. National Water Act, §§40–42.
43. National Water Act, §§22(1)(a)(iii), 39.
44. Some 75 percent of extracted water is used for irrigation. The amount of irrigated land in New South Wales and Queensland has nearly doubled over the last 20 years (Fisher, 2006).
45. While the precise way in which licenses were issued varied across the Australian states, 'significant administrative discretion characterised decision-making' (Godden, 2005).

46. There was a significant difference, however, in the impact of scarcity. Australia has had a tradition of sharing water shortages equally (proportionally), although some water users like horticulturalists were given a higher security of entitlement than annual croppers (Gardner and Bowmer: 2008). That is certainly a much more egalitarian and rational approach than one based upon seniority, where senior appropriators might lose nothing in times of shortage while junior ones lose everything.
47. The Council of Australian Governments (COAG) is the current institutional structure through which activities of the two levels of the Australian federal system are coordinated. Although the states have the power to opt out of policy projects, the fiscal dominance of the Commonwealth is often compelling (Connell, 2007).
48. The legislative implementation of the NWI is discussed in Gardner *et al.* (2009).
49. 'Environmental outcomes' are defined as including the maintainance of ecosystem functions, biodiversity, water quality, and river health targets. 'Other public benefits' are defined as including, but not limited to, the mitigation of pollution (dilution, in other words), public health, indigenous and cultural values, recreation, fisheries, tourism, navigation, and amenity values (COAG, 2004).
50. The NWI, however, does direct, in a general way, that state water market and trading schemes recognise and protect the needs of the environment and also provide 'appropriate protection' for third-party interests (COAG, 2004).
51. The regime to ensure that water trading is compatible with the environment is so complex that one observer believes that 'it is hard to believe that [it] will really be conducted in this way' (Connell, 2007).
52. Doremus states that natural resource management is more 'information intensive' than pollution control because of the constant 'need to anticipate and respond to environmental change' (Doremus, 2008).
53. A '[s]hortage of skilled personnel to manage Australia's highly modified hydrological systems could well prove the greatest source of risk to the NWI and Australian water management in the medium term' (Connell, 2007).
54. Prompted by frustration with the pace of progress under the NWI, the Commonwealth Parliament passed the Water Act 2007, which essentially gave the Commonwealth government responsibility for water in the Murray–Darling Basin. Based largely upon the Commonwealth's Constitutional authority for trade and commerce and foreign affairs, the new scheme aims at the creation of a comprehensive basin plan from water plans drafted under state law and requires that water in the basin be managed in the national interest (McKay and Marsden, 2009).
55. The Water Act 2007 established a Commonwealth Water Holder who will hold and manage the environmental entitlements acquired by the Commonwealth government (Water Act, 2007: §§104–108).
56. So far, most sellers have used the proceeds of the purchases to retire debt (Hyder Consulting, 2008).