1 Ariz. J. Envtl. L. & Pol'y 243

Arizona Journal of Environmental Law & Policy
Spring 2011
Dr. Sharon Megdal[a1]Joanna Nadeau[aa1]Tiffany Tom[aaa1]

*243 THE FORGOTTEN SECTOR: ARIZONA WATER LAW AND THE ENVIRONMENT

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***245INTRODUCTION**

Arizona is renowned for its geographic diversity and natural environment. Yet, the water needs of the environment have often been overlooked as the demands for water of the state's population and economy have grown. Over time, many riverine and riparian areas[1] in Arizona have suffered significant degradation. According to one study, a majority of Arizona's stream lengths have a "most-disturbed" water quality condition.[2] Invasive nonnative species and surface water and groundwater withdrawals have negatively impacted riparian vegetation, streambed, and habitats.[3] Many studies have shown that the increased invasion of non-native species is driven by altered hydrological patterns.[4] Water withdrawal ***246** in certain areas appears to be the primary culprit for the poor ecological state of Arizona's streams and rivers.[5]

This Paper examines the extent to which environmental water needs are--or are not--recognized in Arizona water law. Like many states, Arizona manages surface water and groundwater under two different legal regimes. Arizona's surface water law is grounded in the prior appropriation doctrine of "first in time, first in right." Under this doctrine, the only means of

protecting environmental water needs is through the use of instream flow rights. In 1980 Arizona adopted the landmark Groundwater Management Act (GMA), which introduced groundwater regulation to regions of the state designated as Active Management Areas, thereby adding a body of groundwater law to existing state surface water law. The GMA established rights to use groundwater, water conservation programs, and an assured water supply program related to growing communities. In addition to creating new programs, the GMA recognized the municipal, industrial and agricultural sectors as water-using sectors.

At present, Arizona's surface water law and groundwater law do not consider the water needs of the environment. While environmental considerations have sometimes been taken into account during the development of Arizona's water supplies, this has been done on an ad hoc basis through voluntary efforts. This Paper focuses on the status of Arizona water law in terms of the environment and establishes that the environment is indeed the "forgotten" water-using sector.

This Paper examines federal law, state law, and state policy that affect how environmental water needs are recognized and addressed in Arizona.[6] In addition to highlighting the lack of consideration for environmental needs, the Paper identifies many problems caused by the absence of such consideration. Also, the Paper discusses ways in which existing and new laws could be used to protect the environmental sector in Arizona. It may be that in addition to instituting change in Arizona's law, improving public awareness about environmental water needs and laying the groundwork for comprehensive state water planning will move Arizona forward to recognizing the environment as a water-using sector.

Part II of this Paper presents the reasons that the environment can no longer be treated as the forgotten sector in Arizona law and policy. Part III describes the known supplies and uses of water in Arizona. Part IV discusses federal protections that affect Arizona's waters. Part V discusses elements of Arizona water law that are relevant to environmental water needs. Part VI describes opportunities within the given legal context to help the environment gain a place at the table as a water-using sector. Finally, Part VII offers some concluding remarks.

*247I. ARIZONA'S ENVIRONMENTAL WATER NEEDS

All living things need water. Arizona's streams and rivers function within the hydrologic cycle, or the movement of water between the earth's surface and the atmosphere in different physical states.[7] Powered by energy from the sun and by gravity, water evaporates from the ocean and moves through the atmosphere to land. This water is then deposited over the landmass as precipitation.[8] This moisture travels back to the ocean via overland and subterranean routes, back into the atmosphere by evaporation and transpiration, or into the ground.[9] What is now groundwater may become part of surface water, and some surface water eventually joins groundwater.[10]

In Arizona, the quantity and quality of available water varies dramatically by geography and season, affecting hydrologic processes such as precipitation, runoff, and infiltration. River and riparian ecosystems in the region are adapted to these unique hydrological dynamics. Land and water management[11] can have direct and indirect effects on these hydrologic processes, thereby affecting environmental functions.

The water supplies in the arid Southwest, which are used to meet the growing demands of human population centers, are often withdrawn from environmentally significant areas. Rapid development and reliance on groundwater have caused groundwater overdraft in several areas of the state, often resulting in reduced discharge to groundwater-dependent streams.[12] Surface water is another important source of supply for Arizona's population.[13] In Arizona, many streams are fed by groundwater.[14] If the groundwater is hydrologically connected to surface flows, groundwater pumping can dramatically affect the flows of surface water.[15] While Arizona's population has increased significantly, statewide ***248** water demand has declined or remained stable as a result of retired agricultural lands, increased water use efficiency, and effluent reuse.[16]

Despite the efficiencies in water use and a higher demand for alternative water resources, groundwater pumping and surface water use have affected Arizona's riparian habitats. Riparian zones or areas are frequently discussed as examples of environmental degradation in the West and have received increased attention in the Southwest.[17] Arizona contains a great variety of riparian areas.[18] Described as "ribbons of life," riparian areas are considered one of the most productive habitats in the United States. This is especially true in Arizona, even though riparian areas cover only 113,000 hectares in Arizona (0.4% of Arizona's total area), 40,750 hectares of which are along the Gila River.[19]

Arizona wildlife depend on these riparian areas, especially in arid regions, for foraging, nesting or coverage during part of or during their entire life cycle.[20] Seventy percent of Arizona's threatened and endangered vertebrates depend on riparian habitat.[21] In addition, domestic livestock often rely on these areas to forage and hydrate. Particularly in Arizona, eighty percent of vertebrates spend some portion of their life cycle in riparian areas.[22] These delicate ecosystems can easily be destroyed and a large percentage of riparian zones are considered "in degraded and non-functional conditions and in need of restoration."[23] They are among the most drastically altered ecosystems in the nation. According to one popular source, it is estimated that less than ten percent of Arizona's riparian acreage remains in its natural form.[24] Because of their importance to biotic integrity ***249** and to human populations as well as their delicate nature, the protection, restoration, and maintenance of riparian areas has become a top priority for some Arizona stakeholders.[25]

II. ARIZONA WATER-SOURCES AND USES

Arizona supplies its water demand with surface water, including the Central Arizona Project, and the remainder with groundwater and reclaimed water or effluent.[26] Surface water from the Colorado River and instate surface water is a major renewable supply in Arizona;[27] it accounts for fifty-four percent of the state's annual water use.[28] Arizona has the right to use 2.8 million acre-feet (maf) of water from the Colorado River per year. Of the total 2.8 maf, 1.3 maf of this amount is available to municipal, industrial and agricultural users located on the Colorado River.[29] The remaining allotted amount is delivered via the Central Arizona Project (CAP) to users in the Phoenix, Tucson and Casa Grande areas.[30] The CAP supplies about fifteen percent of Arizona's water use.[31] Reclaimed water, or ***250** effluent, accounts for three percent of Arizona's use.[32] Groundwater serves the remaining forty-three percent of Arizona's water demands.

Arizona has three types of streams and rivers that are distinguished by their flow characteristics: perennial, intermittent, and ephemeral. Perennial streams and rivers flow throughout the year and receive substantial inputs from groundwater.[33] Perennial stream flows vary during the year and may dry up during severe droughts, but the water is always near the surface.[34] Intermittent streams and rivers are connected to groundwater but only flow for a couple of weeks or months each year.[35] And, finally, ephemeral streams and rivers only flow for a few hours or days whenever it rains or whenever a snowmelt event occurs.[36] The streambeds in ephemeral streams are typically well above the water table.[37] Intermittent and ephemeral streams can be distinguished because ephemeral streams have minimal to nonexistent connectivity to groundwater.[38] Generally, washes and arroyos are ephemeral streams. Some ephemeral streams historically did have a connection to groundwater, which was lost due to groundwater pumping.

Current knowledge of human water use is characterized by the Arizona Department of Water Resources' (ADWR) Arizona Water Atlas. The Arizona Water Atlas describes human water use and water sources; it characterizes who uses water and where supplies are located. However, the Arizona Water Atlas does not describe environmental water needs in this state. Without this vital information, local and statewide water policy cannot be developed with proper consideration of environmental water needs.

ADWR's release of its Draft Demand and Supply Assessment for the Tucson Active Management Area (AMA)[39] in May of 2010 provides an example of Arizona's water managers' attempts to recognize environmental water needs.[40] ADWR plans to develop an assessment for each AMA; Arizona law does not require these assessments.[41] In the Draft ***251** Tucson Assessment, ADWR discusses water budget components and calculates overdraft. The demands analyzed include municipal, industrial, agricultural, Indian, and riparian demands. The Assessment describes riparian needs as a "natural demand" on the regional water supply.[42] In the Draft Tucson Assessment, ADWR defines riparian needs as "the water used as a result of evapotranspiration by riparian vegetation along the Santa Cruz River and its major tributaries."[43]

Despite ADWR's characterization of riparian needs, evapotranspiration is not the only element of environmental water use; environmental water use also includes aquatic and other wildlife as well as plant life that depend on water for sustenance. Thus, it would benefit the Arizona Water Atlas and these Assessments to consider other aspects of environmental water use beyond just evapotranspiration. An effort, started in January 2010, has been undertaken in an attempt to increase the information available to ADWR and other water managers about environmental water needs. The Arizona Statewide Environmental Water Needs Assessment (Assessment), a project of the University of Arizona's Water Resources Research Center, intends to identify gaps by compiling and synthesizing all available environmental flow studies completed for Arizona. The Assessment aims to support decision making and planning for environmental water needs and facilitate efforts to address gaps in information about environmental water needs in Arizona.

Quantifying the needs of the environment is a required step in meeting these water needs. As the following sections demonstrate, additional work will be required for the forgotten sector to be recognized by Arizona law.

III. ARIZONA WATER AND FEDERAL LAW

Federal water laws, state water laws, and state technical programs constitute Arizona's water management framework. It is beyond the scope of this Paper to discuss all federal water laws that affect Arizona's waters in detail, but what follows is a cursory look at federal laws affecting environmental water use. The relevant federal protections to environmental water elements include the federal reserved rights doctrine as well as the Clean Water Act, the Endangered Species Act, and the Wild and Scenic Rivers Act. Although these federal protections do in some way affect the overall protection of environmental water needs, environmental water needs are not the focus of any of these federal laws.

***252** Each state has jurisdiction over its waters and has the authority to determine how such waters will be allocated.[44] Generally, state law controls the allocation and administration of water rights.[45] However, if state law interferes with federal law, the state must defer to federal authority. Under certain circumstances, when the government exercises its authority, the Supremacy Clause of the Constitution gives the federal government the power to preempt state law.[46] While the line between state law and federal preemption is not always clear, when it comes to water, the United States Supreme Court has recognized the federal government's power to regulate water through the Commerce Clause of the Constitution.[47] From this general power to regulate water emerges the federal reserved water rights doctrine.

A. Federal Reserved Water Rights

The federal reserved rights doctrine, also known as the Winters Doctrine, was established by the Supreme Court in *Winters v. United States*.[48] The doctrine operates in a particular setting: federal lands. When the federal government reserves public land for a particular purpose, the Supreme Court has recognized an implied reservation of unappropriated water to achieve the purposes of some federal reservations.[49] The amount of water is based on the amount of unappropriated water available at the time of the reservation. This amount is also limited to the minimal amount needed to support the primary purpose of the reservation.[50] Finally, the water rights reservation is dated to the time of the land reservation.[51]

***253** Because federal reserved water rights do not depend on state approval, the federal government can work outside the parameters of state law and reserve the amount of unappropriated water necessary to accomplish the purposes of the land reservation.[52] This means that reserved water rights are generally immune from state water laws, are not subject to state beneficial use requirements, and cannot be lost due to non-use.[53] The Supreme Court acknowledged the power of federal agencies to do this, but federal agencies must secure water rights under state law, meaning under the state's appropriation law, to accomplish secondary purposes on federal lands.[54]

Because the federal reserved rights doctrine applies whenever the federal government reserves land and when it is necessary to accomplish the primary purposes of the reservation, this doctrine often comes into play and is usually the first choice for federal agencies with respect to reserving water on public lands. This may prove especially useful when state law will not protect environmental water needs. However, the federal government only acquires the amount of water needed to meet the purposes of the land's reservation, which only includes environmental water needs if the environment is directly related to the primary purposes of the reservation.

B. Clean Water Act

Water pollution is a major concern when it comes to protecting the quality of water for human use and for the environment. Water pollution can result from industrial, agricultural or municipal activities. Through the Clean Water Act (CWA), established in 1977,[55] federal law for the first time established a strong system of pollution law that ***254** imposed limitations on effluent discharges at point sources.[56] A point source is "any discernible, confined and discrete conveyance" and does not include agricultural, stormwater discharges, and irrigation return flows.[57] The CWA primarily focuses on surface water pollution and does not directly cover groundwater contamination.[58]

Pursuant to section 101, the major goals of the CWA include "restoring water quality in the nation's rivers, lakes, and streams," as well as "monitoring, regulating and restricting pollutants."[59] The goals also include provisions for "protecting the rights of states, encouraging foreign nations to act responsibly, and administration [of the CWA] by the EPA." Although the original act encouraged states to develop ambient water quality standards that were applicable to navigable waters, the states' failure to act motivated amendments in 1972. These amendments established a permit system for "fishable and swimmable waters" and applied a "best practical control technology available" standard on all point sources.[60] Amendments in 1983 changed the standard to "best available technology economically achievable."

The CWA requires the EPA to maintain a list of toxic substances, called priority pollutants, and establish limits for them.[61] States must administer the water quality standards and have the option to impose stricter standards.[62] Section 208, the provision dealing with wastewater[63] management and treatment, requires the development of area wastewater management plans.[64] The CWA limits pollution discharge activities associated with point sources and with Army Corps of Engineers' dredge and fill activities. Ultimately, the CWA offers some protection against water quality degradation that could harm environmental water uses.

One complication that arises with surface water diversions is the fact that water quality can be reduced when upstream uses reduce the amount of water that is available downstream.[65] When water is withdrawn, the pollutant concentration downstream can become very high. This poses a conflict between quantity laws, which are a function of state laws, and quality laws, which are a function of federal laws. The Wallop Amendment was added to the CWA to address this issue; it protects established state water rights from infringement by the CWA.[66] The consequence of this amendment is that the CWA cannot ***255** be used to protect the environment from greater quantities of pollutants if the proposed fix would interfere with established water rights.

C. Endangered Species Act

The Endangered Species Act (ESA) is generally considered the most powerful law providing protection to threatened and endangered plants and animals and their habitats.[67] The two lead agencies responsible for administering the ESA are the Fish and Wildlife Service (FWS), which is responsible for all terrestrial species, and the National Oceanic and Atmospheric Administration (NOAA), which is responsible for marine species and anadromous fish.[68] The ESA has three fundamental goals: to prevent the extinction of species, to ensure their recovery, and to protect the ecosystems upon which these species depend.[69] To meet these goals, the ESA identifies three categories of protected species: endangered species, threatened species, and critical species.[70] Endangered species and their critical habitats receive the strongest protection.[71]

The ESA's wide protective reach can indirectly protect environmental water needs. Destruction or modification of a species' habitat is one of the primary causes of species imperilment.[72] The ESA protects critical habitat, defined as the physical and biological features that are essential to the conservation of the species.[73] The regulations interpret this term to include food, water, air, light, minerals, or other nutritional or physiological requirements as well as sites for breeding, reproduction, and other life cycles.[74] The regulations further allow the Secretary to focus on principal physical constituent elements, such as water quality or quantity, which are essential to the species' conservation, and to list ***256** them in the critical habitat description.[75] Thus, the critical habitat designation would encompass the water quantity and quality necessary to help threatened and endangered species recover, and is thereby protected under the ESA.

Besides the critical habitat designation, the take provision[76] of Section 9 may also have an indirect impact on environmental water needs. In its regulations, the FWS restricts significant habitat modification or degradation where it kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or finding shelter.[77] A 1995 United States Supreme Court decision held that FWS's interpretation was a reasonable interpretation to the term harm.[78] As a result, actions that modify or obstruct water quality or quantity needed for endangered species could possibly be interpreted as a taking.

While the ESA has led to some positive changes in Arizona,[79] it is limited in scope in its ability to protect environmental water needs. The ESA only protects environmental water needs indirectly when they are linked directly to the habitat of an endangered species. The ESA only covers listed species, and not all the species whose numbers are declining. It is only used when a species is in danger of extinction and, thus, is somewhat of a last resort. A species must be listed as threatened or endangered before the Secretary can begin planning to conserve and protect the habitat of that listed species.[80] By the time a

species is listed as endangered, its populations can be so imperiled that major efforts, including expensive habitat restoration measures, are often needed to prevent its extinction.[81]

257*D. Wild and Scenic Rivers

In 1968, Congress passed the National Wild and Scenic Rivers Act ("WSRA"), declaring that selected rivers must be preserved in a free-flowing condition and their immediate environments must be protected.[82] "Free-flowing" means "existing or flowing in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway."[83] Selection of these rivers is based on their outstandingly remarkable values (ORVs), which can be scenic, recreational, geologic, fish and wildlife, historic, cultural and/or other similar values.[84] The WSRA created three classifications for designated rivers: wild, scenic, and recreational.[85] Classification depends on the type and intensity of the river's existing development.[86] A river becomes part of the National Wild and Scenic Rivers System ("National System") either by an act of Congress or through designation by the Secretary of the Interior following protection in a state river system and application by the state governor.[87] Four federal land management agencies--Bureau of Land Management, National Park Service, Fish and Wildlife Service, and Forest Service--are primarily responsible for administering rivers designated within the National System.[88] According to a technical report developed by the Interagency Wild and Scenic Rivers Coordinating Council, the administering agency is responsible for two things: "(1) collecting baseline data during river studies and development of comprehensive river management plans (CRMP) ...; and (2) developing strategies for management of water quantity and ***258** quality in consultation with legal counsel ... and maintaining an ongoing dialogue with legal staff concerning the implementation and evolution of such strategies."[89]

For this Paper's purpose, the most vital part of the WSRA is that it requires the federal government to protect each selected river's instream flow and water quality.[90] Section 13(c) of the WSRA expressly creates federal water rights to carry out these purposes: "designation of any stream or portion thereof as a national wild, scenic or recreational river area shall not be construed as a reservation of the waters of such streams for purposes other than those specified in [the WSRA], or in quantities greater than necessary to accomplish these purposes."[91] Thus, the quantity of a WSRA federal water right is the amount necessary to achieve its purposes.[92] This means that the federal government can only acquire the water rights to preserve the ORVs for which the river was protected. Where this includes ecologically relevant values, environmental water uses would be included. Because the WSRA creates a federal reserved right, this water right can serve not only to preserve the ORV, which may or may not be environmental, but also to incidentally support environmental water needs. Just like any federal reserved right, the water right dates back to the date of the river's designation.[93]

Even though federal water rights are available under the WSRA, agencies have not always asserted them.[94] For instance, if there is another underlying federal water right, such ***259** as a national forest reservation, and this other available federal water right is adequate to provide sufficient water, then a WSRA federal water right might not be claimed.[95] Another possibility for protecting a Wild & Scenic River is simply applying for an instream flow right under Arizona law.[96] This may be a good idea because the quantification of a federally reserved right may take a long time,[97] and a river may need protection as soon as possible.[98]

Upstream landowners, developers, and state and local governments may be concerned about "whether new downstream wild and scenic segments may limit their water use and future water diversions."[99] Suppose the designated portion of the river is located downstream of private lands, and the owners of these lands also have water rights to the river.[100] Where the private appropriators' rights are junior to the federal government's appropriation, then the federal government can place a call on the river. This means the federal government can demand these upstream junior appropriators withhold their beneficial use and provide sufficient water to meet the federal government's WSRA water right.[101] On the other hand, when the private water user's rights are more senior to the federal government's appropriation, the private party's use would have priority over the federal government. One wrinkle in this system is that the WSRA appears to allow the federal government to "take" private water rights. However the government still has to pay for those rights. Section 13(b) seems to give the federal government the ability to condemn other water rights: "any taking by the United States of a water right which is vested under either State or Federal law at the time such river is included ... shall entitle the owner ... to just compensation."[102] As of 2008, however, no water right has ever been condemned under the WSRA.[103]

***260** In Arizona, Fossil Creek and parts of the Verde River have been designated as part of the Wild and Scenic Rivers System.[104] Fossil Creek, extending from the confluence of Sand Rock and Calf Pen Canyons to its confluence with the Verde

River, was designated on March 30, 2009.[105] About seventeen miles of the river is protected under the administration of the United States Forest Service ("USFS").[106] The Verde River begins at Sullivan Lake in Big Chino Valley and flows for 170 miles to the confluence with the Salt River.[107] Forty miles of the Verde River was designated as Wild and Scenic on August 28, 1984 under the administration of the USFS.

Although the WSRA protects rivers for values other than purely environmental, it can be used to maintain flows in a waterway for the sake of environmental water needs. Yet, even the WSRA has limitations in what the federal government can do to protect the ORVs of a designated river. In addition, it might take a long time to quantify the amount of water necessary to maintain the ORV. While federal law does provide some protections for environmental water needs, they are indirect protections. Arizona's water law has more direct protections.

IV. STATE WATER LAW

A. The Public Trust Doctrine

An ancient legal principle, the public trust doctrine protects designated natural resources for the general public, limiting the intrusion of private property rights on public rights in water. The doctrine has evolved into the idea that "certain lands and waters should be held in trust for the public to access for fishing, navigation, and commercial purposes."[108] Yet, in recent years, some states have expanded the doctrine to include specific protection ***261** for recreational and environmental purposes.[109] This expansion has allowed the doctrine, in some instances, to be used to protect environmental water needs.

Under the public trust doctrine, Arizona, in its sovereign capacity, holds in trust the beds of all watercourses located in the state determined to be navigable as of statehood; the state is restricted from disposing of land held in the public trust.[110] The fundamental reason for this restriction is that the state has a fiduciary duty to protect its citizens' resources from the actions of private interests. Specifically, Arizona has a fiduciary duty to protect its waterways so that "[the people of the state] may enjoy the navigation of the waters, carry on commerce over them, and have liberty of fishing therein, freed from the obstruction or interference of private parties."[111] Arizona, as administrator of the public trust, "does not have the power to abdicate its role as trustee in favor of private parties."[112] Thus, there is an inherent easement on these navigable waters for public purposes.[113] Further, the trust doctrine prevents the state from alienating the beds of the navigable waters or from giving up regulatory control of the waters.[114]

Some scholars have identified the public trust doctrine as a remedy to shortcomings in environmental law and society for two reasons.[115] First, scholars look to the trust doctrine as a remedy when they perceive that federal and state statutory law have failed to protect public interests in the environment.[116] The judiciary branch can employ this doctrine to supervise the resource allocation decisions made by the government.[117] Second, the trust ***262** doctrine encompasses a general set of environmental values that is more willing to focus on long-term impacts and purely public values, in contrast to regulatory law.[118]

In Arizona, the trust doctrine has experienced a tumultuous history. While states like California and Hawaii have extended the concept of the public trust,[119] Arizona adheres to a minimalist public trust doctrine-- limited to the equal footing doctrine.[120] Arizona owns the beds and banks of navigable watercourses to the ordinary high watermark.[121] Under Arizona law, navigable waters include waterways that "[were] susceptible to being used, in [their] ordinary and natural condition, as a highway for commerce, over which trade and travel were or could have been conducted in the customary modes of trade and travel on water."[122] Under Arizona's minimalist public trust doctrine, *public trust purposes* or *public trust values* are only restricted to commerce, navigation and fishing.[123] Despite the trust doctrine's minimalist application in Arizona, the state legislature has repeatedly attempted to restrict the role of the doctrine, and the courts have intervened.[124]

Arizona has been slow to apply the public trust doctrine and to determine which waterways the state holds title to under the doctrine. The trust doctrine is an area of particular controversy in Arizona because many of the streambeds are privately owned.[125] This occurred because the trust doctrine had not been applied to determine state ownership of navigable waterways. In 1992, the Arizona legislature created the Arizona Navigable Stream Adjudication Commission (ANSAC) to make these determinations.[126] After holding public hearings, ANSAC has determined the navigability of the state's 39,039 watercourses ***263** as of statehood.[127] Appeals have been filed for six of the waterways. Once ANSAC determines whether a waterway is navigable, then it must, in a separate and subsequent proceeding, identify and make a public report of any trust values

associated with the navigable waterway.[128] This has not occurred yet because of all of ANSAC's determinations are subject to judicial review.[129] To maintain and protect public trust values of a navigable waterway, the state can appropriate water, but must do so under the state's appropriation system.[130] Arizona law also provides a means for refunding taxes and purchase prices, as well as compensation for improvements to the landowners who end up "losing" title to the beds of waters that are determined to be navigable.[131] Additionally, these landowners can petition to release the streambed from public trust values.[132]

If ANSAC determines a waterway is non-navigable, then the state relinquishes all claims to the bed and banks, making it available for private ownership.[133] To protect the public trust values of a non-navigable waterway, the state must use the state's permitting system to acquire a surface water appropriation.[134] The Arizona Court of Appeals, in a case in connection to a conservation district, has implied that the public trust doctrine insulates the state from regulatory takings claims.[135] This is because landowners take property subject to existing and initiated water rights.[136]

Most of the focus of public trust doctrine interpretation in Arizona has been on the title to rivers, not the stream flows that could be protected by the doctrine. In addition to stated public trust values--commerce, navigation, and fishing--the trust doctrine is a tool that can be used to protect much needed water flows for the environment. California has done so. In *National Audubon Society v. Superior Court*, widely known as *Mono Lake*, the California Supreme Court declared that even after approving an appropriation, the state, through the trust doctrine, retained continuing supervisory control over its navigable waters and the streambeds.[137] When exercising such power, "the state [was] not confined by past ***264** allocation decisions which may be incorrect in light of current knowledge or inconsistent with current needs."[138] As a result, the state could reconsider allocation decisions even though the decisions already considered the effect of the allocations on the public trust.[139] This principle of continuing supervisory control applied to rights in flow waters, tidelands, and lakeshores; the doctrine also prevented parties from obtaining vested rights to appropriated water if it was harmful to the interests protected by the public trust.[140] Even when the state approved an appropriation, the state retained an affirmative duty to take the public trust into account and to protect public trust uses *whenever feasible*.[141]

In 1995, the Arizona legislature, in contrast to California, amended its water code in attempt to limit the trust doctrine's application in Arizona. This particular statute declared that: (1) the public trust "[was] not an element of a water right," and (2) a court that is adjudicating water rights "[cannot] make a determination as to whether public trust values are associated with any or all of the river system or source."[142] However, in 1999, the Arizona Supreme Court found this amendment unconstitutional, holding that the legislature could not destroy the public trust doctrine because the doctrine was itself a constitutional limitation on legislative power.[143] Thus, a judge must determine, on a case-by-case basis, whether the doctrine is applicable to the facts.[144]

Despite the Court's holding, no Arizona court has applied the public trust doctrine to limit water rights. Until several cases focusing on the navigability of certain waterways in Arizona are resolved,[145] ANSAC cannot make the public trust value determination pursuant ***265** to Section 37-1128(B).[146] Because ANSAC has never gone through the proceedings to determine public trust values for any waterway in Arizona, the future of the public trust values is quite unknown. Although Arizona statute limits the values to commerce, navigation, and fishing, there is a possibility of expansion. If ANSAC makes a determination of the trust values for a particular waterway, this decision can be appealed to the courts in an effort to expand the definition.

B. Arizona Surface Water Law

As discussed, much of federal and state water law operates under Arizona's prior appropriation laws. The prior appropriation doctrine affects the availability of water for the environment; the environment is a water-using sector, but is not recognized as such. However, instream flow rights, discussed *infra*, do provide some necessary water for the environment. In the United States, two systems of water allocation developed: in the East, the riparian system, and in the West, the prior appropriation system. These systems determined the scope of a person's water rights. The environment is a water-using sector, but does not hold rights. Because the riparian doctrine constrained water rights to those who owned property abutting the water body, this system was not conducive to rapid development of arid lands in the West. The prior appropriation doctrine originated in California by gold miners who needed to divert water over long distances for their mining activities.[147] Unlike the riparian doctrine, the prior appropriation doctrine is based on the principle of "first in time, first in right."[148] The first person to take water and apply it to a beneficial use acquired a property right or an appropriation in that amount of water.[149] Thus in contrast to the riparian system, water rights did not depend on land ownership abutting a stream but instead were based on who could

harvest and put that water to a productive use.

Arizona followed suit with the rest of the Western states.[150] In Arizona, all waters belong to the public, subject to appropriation and beneficial use.[151] These waters include those "flowing in streams, canyons, ravines or other natural channels, or in definite underground channels, ..., flood, waste or surplus water, and of lakes, ponds and springs on the surface."[152] Any person, the state, or a political subdivision of it may acquire an ***266** appropriation.[153] To acquire an appropriation, there must be unappropriated water and an intention to use it for "domestic, municipal, irrigation, stock watering, water power, recreation, wildlife, including fish, nonrecoverable water storage ... or mining uses" either for personal use or for delivery to consumers.[154] Under the traditional prior appropriation doctrine, the beneficial use of the water and a physical diversion from the waterway was required to effect the right; this was easily accomplished in the past because the water usually was transported to places far away from the actual water source. The Arizona Court of Appeals has interpreted the statutory language discussing diversion as to not require an actual diversion in order to prove a valid water right.[155] The beneficial use requirement still remains.

There are several features of the prior appropriation doctrine that limit an appropriator's water right. The first constraint is a limit on the appropriator's ability to rely on a future investment of water. Generally, an appropriator cannot hold a right for future use.[156] As long as an appropriator is using water beneficially, the appropriator holds that water right. But once the appropriator fails to make such a use, the right is lost. The doctrines of abandonment and forfeiture deal with this type of loss.[157]

A second limitation is the seniority system. The prior appropriation doctrine "adheres to a seniority system determined by the date on which the user initially puts water to a beneficial use."[158] Thus, in Arizona, the "first appropriating the water shall have the better right."[159] When there is not enough water to meet all appropriators' rights on a stream, then preference is given to those with the most senior appropriation dates.[160] This is a particularly important aspect of the doctrine in Western states with scarce water resources where sometimes all water needs cannot be met. At certain times, junior appropriators can find themselves with no water.[161]

The final limitation, and the most relevant to environmental water rights, is the beneficial use standard. Beneficial use determines the amount of surface water an appropriator is allowed to use.[162] The term means that an appropriator has a right to a certain quantity of water, measured at the point of diversion, or for instream flows, the ***267** amount required to flow in the waterway.[163] The use must be for a permissible and non-wasteful use based on custom, and it must be reasonably efficient.[164]

The beneficial use concept was a creature of its time, reflecting the social and economic values placed on water use in an undeveloped and arid west.[165] This concept favored industry, mining, and agriculture at the expense of environmental water needs. The environment was not a recognized water user in the past. However, because Arizona law today recognizes recreation, wildlife, and fish as beneficial uses, environmental protection can be the "use" of the water.

There are some additional protections for the environment that go beyond the beneficial use standard. Whenever an application for a new water right is submitted to ADWR, the director is obligated to consider whether the proposed use is against the interests and welfare of the public.[166] If the proposed use conflicts with the public interest or welfare, the application must be rejected.[167] Despite this requirement, no Arizona court has applied this part of the law in affirming ADWR's rejection of an appropriation application. Further, if there are two or more pending applications and there is not enough supply sufficient for all applications, Arizona law delineates a list of preferred uses: domestic and municipal use, irrigation and stock watering, power and mining uses, recreation and wildlife, including fish, and non-recoverable water storage pursuant to Section 45-833.01.[168] So when an application for recreation or wildlife uses conflicts for the same water as an application for any of the more valued uses, then recreation and wildlife uses will always lose. Environmental water needs are given limited consideration, although this situation would only occur when the applications are made at the same time.

1. Instream flows

An instream flow (ISF) claim is a water right in which the beneficial use of the water is dedicated to one or more specified instream uses of water, such as recreation or wildlife needs.[169] To meet those needs, the water must remain in the stream. In Arizona, these instream flows can be used for recreation, wildlife and fish.[170] The appropriation of water for the purposes of wildlife, including fish, was added to Arizona's beneficial use definition in ***268** 1941,[171] and the purpose of recreation was

added in 1962.[172] The statutory right of the State to actually make an appropriation for this purpose was not added until 1962.[173]

Arizona officially recognized ISF rights in then-Governor Rose Mofford's 1991 Executive Order.[174] The Executive Order recognized the critical state of Arizona's riparian areas and determined that the policy of Arizona should be "to recognize that the protection and restoration of riparian areas are of critical importance to the State" and "to actively encourage the preservation, maintenance, and restoration of instream flows throughout the state."[175] Governor Mofford also authorized ADWR to develop rules that would allow ISF applications to be filed, to develop legislation for instream flows, and to facilitate the protection of riparian water use.[176] Thus, Arizona recognized ISFs as water rights. While ISF applications were submitted, a legal issue barring their approval remained unsettled until 2005.

The serious legal issue ISFs posed was whether the appropriator must physically remove water from the stream or at least exercise some physical dominion over it to meet the "diversion" requirement for establishing a right. In 2005, Arizona finally resolved this legal issue in *Phelps Dodge*.[177] In that case, the Forest Service had filed an application for an ISF right. Phelps Dodge filed a protest and argued that because Arizona followed the prior appropriation system, a physical diversion was an essential element of an appropriation.[178] Thus, Phelps Dodge challenged ADWR's authority under Arizona law to issue instream flow water rights.[179] The Arizona Court of Appeals held that Arizona law did not require a physical diversion to perfect a water right.[180] As a result, ADWR maintained its authority to ***269** issue permits to appropriate water for ISFs, even though these appropriations did not involve a physical diversion of water.[181]

An instream flow right is most valuable when it is a senior one.[182] When an instream right is more senior than other rights nearby, there is a higher chance that there will be enough water in the stream to meet the appropriation. However, most instream flows are the most junior right (because they were obtained most recently) and, therefore, have to wait until all the more senior appropriators' rights have been satisfied before water can stay in the stream for wildlife and recreation.[183]

As of June 2010, ADWR has received one hundred and twenty instream flow applications. The ADWR requires any person seeking to obtain an ISF to gather at least a year of flow data to submit an application. Also, the applicant has to submit a report of the flow measurements and a conclusion of expected benefits. Because of the amount of information required for an application, in reality public agencies and private conservation organizations are the ones that will seek an instream flow right.[184]

While Arizona law does allow anyone to acquire an instream flow appropriation, the law only allows the state or one of its political subdivisions to hold severed and transferred ISF rights. Any appropriator can transfer their water right for instream flow purposes, but the right must be permanently transferred to the state if the right is to retain its priority date: an appropriator can transfer his water right "to the state or its political subdivision for use for recreation and wildlife purposes, including fish, without losing its priority."[185] Besides the government, so far only the Nature Conservancy and a few individuals have held instream flow rights in Arizona.[186]

2. Loss of an appropriation

The loss of an appropriation affects the availability of water for environmental needs. There are three ways an appropriator can lose a right: by abandonment, forfeiture, and adverse possession. The focus here will be on abandonment and forfeiture.[187] Courts ***270** have generally been reluctant to enforce these laws. Abandonment is a common law doctrine; it occurs when the appropriator manifests an intent to abandon and actually relinquishes the water right--mere non-use by itself usually is not sufficient for per se abandonment.[188] The person alleging abandonment has the burden of showing by clear and convincing evidence that these elements were met.[189] If such evidence is presented, the burden would shift to the appropriator to show that there was no intent to abandon. If abandonment is found, then the appropriator loses the water right, and the water goes back to the call of the river, ready for appropriation by the public. Arizona law does recognize some excuses for abandonment and forfeiture that deal with water exchange arrangements or substitutes; for example, exchanging surface water for groundwater, effluent, or Colorado River water (including CAP water) does not constitute abandonment.[190] From the statutory language, it seems that the appropriator only loses the portion not used: "shall relinquish such right or portion thereof."[191] In a recent case discussing abandonment, the Arizona Court of Appeals also seems to favor this approach.[192] In that case, the court found that the specific portion of the water right that was abandoned resulted in a relinquishment of only that portion.[193]

In contrast, forfeiture is a statutory construction; it occurs when the appropriator ceases or fails to use the water appropriated for five successive years.[194] Arizona law exempted from forfeiture all water rights initiated before June 12, 1919.[195] Section 45-189 governs forfeiture proceedings. Arizona recognizes a variety of excuses for forfeiture: nonuse due to drought or other unavailability of water, active service in the armed forces, non-voluntary service in the armed forces, operation of legal proceedings, and federal, state or local laws imposing land or water use restrictions, among others.[196] If forfeiture is found, the right to the use terminates; the water reverts to the public and is subject to appropriation.[197] If forfeiture is found, there are three general possible consequences: the appropriator does ***271** not lose anything because *some* water was used during that time; all rights are forfeited because there was non-use during the statutory prescription; or the appropriator only loses the portion that was not used, which was the non-beneficial part. Again, from the statutory language, it seems that an individual only loses the portion that was abandoned or forfeited and not the entire water right.

Abandonment and forfeiture are related to the doctrine of waste, especially in the area of conservation, which can affect environmental water needs. Any water that is conserved goes back to the stream and can be used for environmental needs--the water remains in the water body unofficially for the benefit of the environment. If an appropriator can use his water more efficiently by employing more modern irrigation techniques, that appropriator risks losing that portion of saved water under the doctrine of waste.[198] The laws of abandonment and forfeiture can also apply to this same scenario. If an appropriator decides to use his water more efficiently, the water not used could be deemed abandoned or forfeited, depending on whether the elements are met for each doctrine. Thus, the risk of losing a water right through abandonment and forfeiture creates a strong disincentive against using it for an unapproved purpose or simply conserving it.[199] As a result of the waste, abandonment, and forfeiture doctrines, appropriators will continue to use water at "historical rates and through historical means" because they fear losing any unused part of their rights.[200] Even though water that is used more efficiently can reduce input costs like labor and energy, the appropriator must weigh these benefits against the potential lost value of the right itself.[201]

Besides creating a disincentive to conserve, forfeiture also creates a small disincentive to appropriators who want to lease their water rights for ISF purposes. Appropriators can lease their water rights as long as they renew the lease every five years to prevent loss of the right by forfeiture.[202] This is another impediment to protecting environmental water needs because renewal must be made every five years or such a right will be lost.

3. The Doctrine of Recapture

The beneficial use standard is the measure of an appropriator's right.[203] Whenever courts analyze the issue of whether water was used beneficially, it typically concerns whether ***272** the use was actually wasteful.[204] Courts have held that wasteful use of water is not a valid use of an appropriation.[205] Agricultural waste, the focus of most courts' attention, includes transmission losses, which occur due to unlined ditches or by evaporation, and overuse of water on crops.[206] Prior to the permitting system, custom played a role in defining the acceptable amount of water needed for a particular use. This was loosely defined in favor of appropriators; conservation requirements were limited. In 1984, in a rare discussion of the waste doctrine, the United States Supreme Court found that a user is required to take only conservation measures that are "financially and physically feasible" and "within practicable limits."[207] The challenger of the use has the burden of proving financially and physically feasible means for eliminating or reducing inefficient use.

Rarely has a court labeled a use as wasteful unless there was substantial transmission loss.[208] There is not much Arizona case law discussing the issue of waste. But in those infrequent cases, the court typically ruled in favor of the appropriator.[209] Today the water right application process is stricter. In ADWR's appropriation application, applicants must fill out a detailed worksheet for the proposed uses of the water.[210] For instance, if the applicant proposes to use the water for irrigation, the applicant must delineate the types of crops and multiply the number of acres times the standard quantity per acre for the crop to calculate the annual acre feet. Irrigation use is site specific and dependent upon crop type, land elevation, soil characteristics, method of irrigation, and conveyance system.[211] Even though the contemporary permitting system for surface water is stricter, most courts are unwilling to take away or limit the scope of senior appropriators' water rights merely because ***273** they may be using the water inefficiently. This is because if the inefficient use is the usual and ordinary means of utilizing the water, then waste is allowed.[212] Allowing wasteful use may have incidental, but very important, environmental benefits, when it results in return flows downstream.

The environment does not seem to fare any better under the rules of recapture. In a common scenario, an appropriator irrigates his land using traditional techniques; a certain amount of water is not consumed and instead drains off the land or seeps into the ground and is used by others who are typically not appropriators of the stream--they are termed "seepage appropriators."[213] This cycle continues for years, until the appropriator decides to recapture the runoff and then reuse it.[214] The general rule seems to be that an owner of land can always recapture seepage water to the detriment of an adjoining owner who had been taking the water from a source that was not a stream--though the water recaptured would have to be used within the original land and purpose of the original right.[215] The environment does not fare better because the appropriator can recapture this water. However, an appropriator cannot try to recapture water against a user who obtained the seepage after it returned to the stream.[216] The person using the seepage after it has returned to the stream is an appropriator of the stream too. Thus, seepage that returns to the stream results in increased flows, but these flows may not remain in the stream for the benefit of the environment because downstream users may be using this returned flow as part of their appropriation.

4. Treated effluent

In 1989, the Arizona Supreme Court decided the issue of whether and how effluent could be regulated by the state.[217] It held that effluent was neither surface nor groundwater, and the cities involved in the case could put the effluent to any reasonable use that they saw fit.[218] The court also ruled that the cities were not required to continue discharging to the same point to satisfy the needs of downstream appropriators.[219] The court reasoned that "no appropriator [could] compel any other appropriator to continue [wasting water] which benefits the former. If the senior appropriator, through scientific and technical advances, can utilize his water so that none is wasted, no other appropriator can complain."[220] The downstream junior appropriator using wastewater merely takes a risk by relying on continued ***274** flow.[221] The cities could change the location of their discharge point without violating any duty owed to downstream appropriators. With the court's holding, the cities were able to keep their contracts to provide effluent for the proposed Palo Verde Nuclear Power Plant, allowing a more economic use of the treated wastewater.

This holding gives cities more flexibility when it comes to assisting the recovery of riparian zones because cities own their effluent and can do whatever they please with without fearing the loss of the effluent through forfeiture. In arid regions, supplemental inputs of water are needed for restoration activities to support revegetation plans.[222] Treated wastewater is a viable option that has been used in some projects. Wastewater that is simply discharged into an empty riverbed can have some restorative effects on the local environment and can help recharge groundwater aquifers. Another common option is to use constructed wetland systems that treat and recycle wastewater. Constructed wetland systems are engineered wetlands that mimic natural wetland components, such as wetland vegetation, soils and associated microbial assemblages.[223] They are used to treat effluent or other water sources.[224] Studies have shown that many "wetlands systems are able to provide an effective means of improving water quality without creating problems for wildlife."[225] These systems take advantage of the processes that occur naturally in wetlands. While some systems have been designed and operated solely for treating wastewater, many others have a multi-use objective of treating wastewater and providing a water source for the creation and restoration of wetland habitat for wildlife use and environmental enhancement.[226]

While there are benefits to using treated wastewaters for wildlife use and environmental enhancement, there are also drawbacks. For example, there may be negative consequences to the environment if effluent that supports environmental uses is later moved or removed. Additionally, in some cases there is evidence of "a resulting change in wetland community types and a shift to more opportunistic species" in response to wastewater flows.[227] The quality of the treated effluent and its effect on the environment is also not necessarily benign. There are concerns about the possible harmful effects due to toxic materials and pathogens that can be present in wastewater.[228] According to one study, "large volumes of effluent in wetlands can contribute to contamination of surface waters used for ***275** recreation and drinking water abstraction and, therefore, represent a serious public health threat."[229] Where wastewater is discharged into naturally occurring wetlands, there are concerns about potential long-term degradation as a result of additional nutrients and changes in the natural hydrologic conditions.[230] While the quality of treated wastewater and its effect on the environment are extremely valid concerns, it is still a viable option for meeting critical environmental water needs. The uses of effluent have tended to be discretionary and can be changed at any time. Given that effluent discharge can be relocated without restriction, some restoration projects are relying on insecure water supplies.[231]

C. Arizona Groundwater

When Europeans first settled the arid regions of the West, farmers, miners, cities, and homeowners found groundwater an attractive source of water.[232] Unlike surface water, groundwater is available for use throughout the year, which is important in arid regions where the availability of surface water diminishes during dry seasons.[233] Further, the use of groundwater eliminates both the cost of construction for transporting surface water and the inevitable water loss due to evaporation and infiltration of water from earthen ditches.[234] In Arizona, groundwater is generally considered to be higher quality because some surface water sources are higher in salinity; but this may not always be true.[235]

The legal system governing groundwater use also makes groundwater a more attractive source.[236] While surface water is governed by the prior appropriation doctrine, under Arizona's common law, groundwater is not appropriable and can be pumped by the overlying landowner, limited by the doctrine of reasonable use.[237] Under this doctrine, ***276** property owners have the right to capture and use groundwater beneath their land for a beneficial purpose on that land.[238] Arizona groundwater law developed from the "territorial-day view that a landowner has a property interest in groundwater underlying the surface estate."[239] Later decisions held that mere ownership of the land did not constitute ownership of the groundwater; instead it simply gave the landowner a right to pump and use the groundwater for the benefit of the land.[240] In other words, groundwater is not "owned" until it is pumped from the ground--landowner has no right to enjoin neighbors from lowering the water table under the landowner's property.

The concept of reasonable use is vague. As long as the use is deemed reasonable, any person can pump groundwater from an aquifer underlying that person's land, even if it results in the diminution of another overlying landowner's water supply.[241] A use is reasonable "so long as it is taken in connection with a beneficial enjoyment of the land from which it is taken. If it is diverted for the purpose of making reasonable use of the land from which it is taken, there is no liability incurred to an adjoining owner for a resulting damage."[242]

1. The Relationship Between Surface Water and Groundwater

Arizona law regulates groundwater and surface water differently.[243] According to Arizona law, groundwater is "water under the surface of the earth regardless of the geologic structure in which it is standing or moving. [It] does not include water flowing in underground streams with ascertainable beds and banks."[244] This split in the law provides a workable legal system, but "it ignores the scientific reality that groundwater and surface water are often connected"[245] and that "the boundary between surface water and groundwater is not always clear."[246]

Groundwater pumping can lower the water table surrounding a well; in these situations, the pumping creates a "cone of depression."[247] The shape of the cone depends on ***277** several factors, especially the rate the water is being pumped and the permeability of the soil. Eventually, the pumping and the subsequent growth of the cone of depression will draw water away from a stream that is hydrologically-connected.[248] As a result, there can be devastating effects if the cone of depression reaches a riparian area.[249] The cone of depression can lower the water table below the root zone, which reduces evapotranspiration and can damage plant and animal habitat.[250]

Because Arizona practices two different water management schemes for surface and groundwater, conflicts can arise when groundwater is hydrologically-connected to surface water. Those with land overlying an aquifer could pump groundwater for the beneficial use of their land as long as the uses are reasonable.[251] But if the aquifer was the source of surface water, nothing protected the surface water appropriators from the depletion of their water source.[252] Early on, Arizona courts began to recognize this scientific reality. Hydrologically-connected groundwater was first called "subterranean streams," but was later termed "subflow."[253] In several early cases, the Arizona Supreme Court defined this hydrologically-connected groundwater as subsurface flows located in "natural channels, between well-defined banks."[254] In a 1931 case, known as *Southwest Cotton*, the Court described subflow as "those waters which slowly find their way through the sand and gravel constituting the bed of the stream, or lands under or immediately adjacent to the stream, and are themselves a part of the surface stream."[255]

After over seventy years, the Arizona Supreme Court issued a decision which affirmed its holding in *Southwest Cotton* and remanded for the trial court judge to determine the proper procedure for separating appropriable subflow from non-appropriable groundwater.[256] But because the Court relied on the same scientific presumptions as it did in *Southwest Cotton*, the Court received much criticism. After carefully researching, the trial court judge came up with a more scientifically valid subflow definition. Finally, in *Gila River IV*, ***278** the Arizona Supreme Court affirmed the trial court's definition of subflow as the "saturated floodplain Holocene alluvium."[257] Any underground water designated as subflow is

subject to the prior appropriation doctrine pursuant to Section 45-141(A).[258] There, the Court specifically defined subflow as "a zone where water pumped from a well so appreciably diminishes the surface flow of a stream that it would be governed by the same law that governs the stream."[259] Now, whenever ADWR faces the question of whether groundwater is subflow relating to a general adjudication such as the Gila River Adjudication, ADWR must ask whether the drawing of the underground water tended to diminish appreciably and directly the flow of the surface stream.[260]

In January 2002, the same court issued a minute entry ordering ADWR to prepare a report for the Gila River Adjudication "specifically identifying and describing the procedures and processes it proposes to use to establish the limits of the subflow zone."[261] In 2005, the court approved ADWR's report, "Subflow Zone Delineation Report for the San Pedro Watershed."[262] Twenty-six objections and comments were filed by claimants concerning this report; on March 15, 2011, the claimants presented their legal and technical objections before the court.[263]

Although Arizona does recognize the existence of subflow and has developed a procedure for determining a subflow zone, such determinations are highly contentious and can take years to resolve.[264] This may not be the most expedient or efficient way of protecting environmental water needs.

279*2. *The 1980 Groundwater Management Act

The common law doctrine of reasonable use governed groundwater law until the Groundwater Management Act (GMA) of 1980 superseded it for some parts of Arizona.[265] Several events in the 1970s led to a reform in Arizona's groundwater law.[266] Continued over-drafting of the state's aquifers threatened the state's economic well-being.[267] In addition, then-Secretary of the Interior Cecil Andrus threatened to take away Arizona's funding to construct the CAP unless the state overhauled its groundwater law.[268] In what became known as the *FICO* case, the Arizona Supreme Court issued a ruling that prohibited the transportation of water off the overlying land if the water was not used to benefit the overlying land, but was merely transported to and used on other property.[269] This decision threatened the water supply of cities that relied heavily on transported groundwater, such as mining towns and Tucson.[270] These factors helped push the effort for a change in Arizona's groundwater law and the creation of the GMA.

The GMA declares that it is the policy of Arizona "to conserve, protect and allocate the use of groundwater resources."[271] In doing so, the GMA established a regulatory framework for the comprehensive management of groundwater.[272] Aimed at reducing Arizona's overdraft of groundwater, the GMA established a system of quantified groundwater rights for existing users and conservation requirements in certain areas known as Active Management Areas (AMAs).[273] The GMA grandfathered existing groundwater uses,[274] made some rights transferable,[275] restricted most new groundwater uses,[276] and ***280** authorized a new agency, the ADWR, to manage groundwater in the state.[277] As a result, the GMA altered Arizona's groundwater common law.[278] Areas outside AMAs are still governed by the common law groundwater doctrine of reasonable use.[279] An example of the alteration in Arizona's groundwater law is that in certain situations a landowner can withdraw groundwater "subjacent to his land subject to restrictions imposed by the GMA and the Groundwater Code."[280] But the most innovative aspect of the GMA is the restriction on the use of groundwater for new residential developments and some new industry in three of the four original AMAs.[281]

The GMA divided the state into three categories: Active Management Areas (AMAs),[282] Irrigation Non-Expansion Areas (INA)[283] and "all other areas".[284] AMAs are defined as "geographical areas where groundwater supplies are imperiled."[285] The GMA initially created four AMAs: Tucson, Phoenix, Prescott, and Pinal.[286] The Santa Cruz AMA was later added.[287] Not all the AMAs have the same goal. The Phoenix, Prescott and Tucson AMAs seek to obtain safe-yield by 2025.[288] Similarly, the Santa Cruz AMA seeks to establish safe-yield and to prevent local water tables from experiencing long-term declines.[289] But since the Pinal County AMA is made up of predominately agricultural lands, the goal differs and focuses on the "development of non-irrigation uses," and the "preserv[ation] [of] existing agricultural economies ... for as long as feasible."[290]

***281** The GMA designated the Douglas critical groundwater area and the Joseph City critical groundwater area as INAs and laid guidelines for future designation of INAs.[291] The Harquahala area was later designated as an INA.[292] The Director of ADWR can designate an INA if there is insufficient groundwater to provide a reasonably safe supply for irrigation at the current rates of withdrawal and the establishment of an active management area is not necessary.[293] When an area is designated as an INA, a restriction is placed on the number of irrigated acres that can be added in an area.[294]

Arizona's groundwater code exempts from regulation small non-irrigation wells. If a well is used for non-irrigation purposes, has a maximum capacity of thirty-five gallons per minute, and was drilled before April 28, 1983 (or drilled after that date, but there was a notice of intention to drill on file with ADWR), then the well is exempt from the groundwater code restrictions and does not need to be registered.[295] New exempt wells can also be drilled.[296] Since wells do not need to be registered, it is unknown how many wells exist or how the wells affect aquifers.[297] While one well might not have an impact on groundwater wells, a large number of these exempt wells can have an impact on groundwater levels.[298] These exempt wells have affected the underground water sources for rivers and have damaged riparian habitats that are dependent on these surface water flows.[299]

3. Relationship between the Groundwater Management Act and Environmental Water Needs

One of the basic features of the GMA is the Assured Water Supply (AWS) Program.[300] The AWS program requires land developers[301] in AMAs to demonstrate an ***282** assured water supply.[302] A developer cannot obtain a subdivision plat approval without demonstrating: (1) a 100-year water supply to satisfy the subdivision's needs is "physically, legally, and continuously available"; (2) the water supply is of sufficient quality; (3) the water use is consistent with the management plan and AMA's management goal; and (4) the developer has the financial capacity to construct the water infrastructure to use the available water supply.[303] If a development is located with a municipal supplier's service area, then the developer can simply obtain a written commitment of the water service as long as the provider has been designated as having an assured water supply.[304] This means that the developer may not drill new wells but must obtain water from the existing service provider. But if the development is outside such areas, then the burden is upon the developer to meet the AWS requirements. Developers can meet their AWS requirements by enrolling into the Central Arizona Groundwater Replenishment District (CAGRD). The CAGRD was created in 1993 to enroll members who were obligated to replenish groundwater use considered to be "excess groundwater" according to the AWS rules' detailed calculations.[305]

The basic criteria needed to get a certificate of AWS have been in place since 1980 by statute, but the 1995 AWS Rules, which are ADWR's regulations, made some changes that are relevant to environmental water needs. The 1995 AWS Rules strengthened the consistency with the management goal requirement; it now mandates that applicants demonstrate the use of renewable water supply, instead of groundwater, in the amount necessary to meet most of the development's demand for 100 years. The rules established standards for the use of renewable water resources. But if a proposed source is groundwater, then a hydrologic study of the affected area must be conducted and submitted with the application for AWS. Groundwater is considered physically available only if certain depth-to-static water level standards are not exceeded in 100 years.[306] Depth-to-static water means the level at which water stands in a well when no water is withdrawn by pumping or by free flow.[307] Basically, the law places a limit on how far below the surface water can be pumped in the next 100 years. The 1995 AWS Rules raised the physical availability depth-to-static water standard. The physical availability depth-to-static water standard changed from 1,200 to 1,000 feet below land surface in the Prescott, Phoenix, and Tucson AMAs, and 1,100 feet ***283** in the Pinal AMA.[308] However, the rules do not establish a depth-to-water standard for the Santa Cruz AMA.[309]

These depth-to-water standards were not based on hydrological studies to determine the level of pumping that would still allow the aquifer to obtain safe-yield by 2025. Instead, the depth-to-water standards were based on the maximum well depth allowed for a well in Arizona's 1973 Water Adequacy Program, which still applies today for areas outside of AMAs.[310] Due to the hydrologic connection between groundwater and surface water that may exist in some places, these standards can have implications for rivers and streams and, consequently, for environmental water needs. For example, in the Tucson AMA, the rule states that groundwater can be pumped as long as the groundwater does not dip 1,000 feet below the land surface in the next 100 years. In places where groundwater is hydrologically-connected to surface water, groundwater falling this far below the surface could cause surface water flows to decline and may drop the water table below the root zone in riparian areas.[311] When the water table drops below the root zone, plants are damaged and animal habitat is affected.[312]

D. Riparian Focused Legislation

1. Riparian Protection in Arizona

Beginning in the 1980s, Arizona took major steps towards riparian protection and restoration. Some actions in the 1980s

include: in 1985, the establishment of the Governor's Task Force on Recreation on Federal Lands; in 1986, publication of the *Arizonans' Recreation Needs on Federal Lands*; in 1988, publication of the *Arizona Wetlands Priority Plan*, which was an addendum to Arizona's 1983 Statewide Comprehensive Outdoor Recreation Plan (SCORP); in 1988, publication of the *Report of the Commission on the Arizona Environment*; the 1989 *SCORP*; and the 1990 publication of the *Final Report and Recommendations of the Governor's Riparian Habitat Task Force*.[313] Additionally, former Governor Rose Mofford issued Executive Order 89-16 in 1989 and Executive Order 91-6 in 1991 to address the protection of riparian areas.[314]

As part of an effort to address the public concern for riparian areas, the Arizona Legislature passed the Riparian Area Act in 1992.[315] In addition to amending ***284**A.R.S. Section 45-101, which provides the definition of a riparian area,[316] the Act contained three components. One part directed three state agencies to study different aspects of riparian areas.[317] The second part formed and directed the activities of the Riparian Area Advisory Committee (RAAC).[318] The third part was the final recommendations for protecting, maintaining and restoring riparian areas developed by RAAC.[319] The RAAC created a possible structure for riparian area planning; these plans would be unique to an area, locally driven, provided with technical and financial assistance, and have minimal to no regulatory authority.[320] The purpose of the planning was to develop recommendations that the Arizona legislature would consider and, hopefully, institute change in Arizona law that would help protect and restore riparian areas. These recommendations were submitted to the Governor and legislature, but they did not result in changing any existing state regulations at that time. Again, this was another failed attempt to help riparian areas in Arizona.

In 2000 at the Conference on the Twentieth Anniversary of the GMA, then-Governor Hull announced the establishment of the Governor's Water Management Commission (GWMC).[321] The GWMC was tasked to review the GMA and recommend changes to make sure that the AMAs were able to meet their current and future water demands.[322] The GWMC released its Final Report in 2001 and acknowledged that environmental water needs were not addressed in the GMA.[323] The Final Report included some recommendations that, if adopted, would have addressed some environmental water needs within the state. These recommendations were never adopted.

2. Arizona Water Protection Fund

In 1994 the Arizona Legislature established the Arizona Water Protection Fund (AWPF). The AWPF has a legislative goal of providing funds to develop and implement measures that would "protect water of sufficient quality and quantity to maintain, enhance and restore rivers and streams and associated riparian habitats, including fish and wildlife resources that are dependent on these important habitats consistent with existing water law and water rights."[324] The creation of the AWPF stemmed from one of several relinquishments of Central Arizona Project (CAP) water by entities outside its service area.[325] In 1983, CAP allocations were determined by then-Secretary of the Interior James Watt for ***285** Indian uses, non-Indian municipal and industrial uses, and non-Indian agricultural uses.[326] When these CAP deliveries were allocated in Arizona, several communities, mining companies, and private water companies that were not in its service area were designated to receive allocations.[327] The Town of Payson was one of them.[328]

Payson planned to develop local surface water supplies, most of which were owned by the Phelps Dodge Corporation and the Salt River Project (SRP).[329] However, due to certain environmental issues associated with the potential exchange of its CAP entitlement for East Verde River water rights held by SRP, Payson decided to sell its CAP entitlement to the City of Scottsdale.[330] The relinquishment of its CAP allocation ultimately enabled Payson to acquire water rights in the Blue Ridge Reservoir in 2004. At this time, then-Secretary Bruce Babbitt sought to use the monies to be refunded to Payson to establish a riparian restoration fund for environmental projects in the West.[331] Concerns were expressed by political and administrative leaders about the confiscation of state tax dollars for environmental projects outside of Arizona.[332] At the same time, there was an interest in developing some kind of program to protect and restore riparian areas in Arizona. Despite this interest, the issue of regulatory programs for riparian protection had long been a source ***286** of political conflict in Arizona.[333] Regulatory protection for riparian areas could not pass through the legislature.[334] The legislative impasse, combined with the political scenario, created an impetus for change. To quickly resolve the dispute with Secretary Babbitt and to allow Payson to receive its refund, the state legislature authorized the creation of the AWPF.[335] In the end, none of Payson's public monies were used to start the fund proposed by Secretary Babbitt; instead, the monies were refunded to Payson and the AWPF became a reality.[336]

The AWPF is a riparian protection and enhancement program that operates at a local scale.[337] The purpose of the AWPF is to

provide funding for developing and implementing projects to protect water quality and quantity to maintain, enhance and restore rivers and streams and their associated riparian habitats.[338] The AWPF Commission is composed of fifteen appointed citizen-based voting members and two non-voting state agency members.[339] Parties interested in receiving AWPF funding can apply to the Commission. The AWPF Commission's role is to "evaluate, select, and administer these grants to local parties."[340] In light of its role, the AWPF is not a guarantee of riparian protection. First, its annual funding of five million dollars is subject to legislative appropriation, which has seldom been provided.[341] Second, because AWPF is decentralized and non-regulatory in nature, it operates at an inherent disadvantage. AWPF must be approached by individuals, organizations, or government agencies who want to put the time and effort into creating a riparian enhancement plan.[342] Participation in AWPF is completely voluntary and functions on an ad-hoc basis. Individual projects may not achieve all of their restoration or protection goals. Of course, AWPF policies have established rules ensuring that plans complete proposed work and have some elements like post-project reporting and monitoring.[343] AWPF also does not have the resources to ensure that the local landowner continues to maintain the AWPF-supported riparian improvements in subsequent years and decades.[344] Further, there is no regulatory regime that identifies riparian areas in need of ***287** rehabilitation and identifies a person responsible for this rehabilitation. Thus, there is no systemic manner for protecting riparian areas in Arizona.[345]

It appears that the AWPF may be the only program that is designed to protect the riparian environment in Arizona; the AWPF may be the exception that proves the rule that the environment is "forgotten" in Arizona water law.

V. FUTURE OPPORTUNITIES

While there are some limitations in the protections offered by federal and Arizona water related law, there are future opportunities for change. This section is divided up into two sections: regulatory advantages that already exist and changes that can be made; and voluntary transactions.

A. Regulatory Advantages that Already Exist and Changes that Can be Made

1. Federal Protections

a. Federal Reserved Water Rights

The doctrine of federal reserved rights, grounded in the Constitution, enables the federal government to preempt state law when it comes to regulating water.[346] Whenever the federal government reserves or acquires land for a particular purpose, there is an implied reservation of unappropriated water to achieve the reservation's purposes, depending on those purposes.[347] Through this doctrine, the federal government can obtain water rights for unappropriated water, and that water right dates to the time of the land acquisition.[348] If a reservation or acquisition of land for federal purposes would give the federal government a more senior right based on the date of reservation, as compared to a new instream flow appropriation under state water law, then the environment would be benefitted more by the federal government exercising its federal reserved right. Of course, the federal government would still have to apply through ADWR to obtain a water right for the purposes of the reservation; the right has the advantage of the earlier reservation date. The federal reserved right gives federal agencies a potential tool to protect environmental water needs against other existing users with a lower priority. Even if the purpose of the reservation is not related to the environment, for example the purpose of recreation, the environment still benefits from water flows that remain in the stream. Thus, in places where the federal land ***288** agencies exercise their rights, instream (and groundwater) environmental water needs can be protected.

b. Other Federal Laws

Besides constitutional protections, there is an array of federal laws that indirectly address environmental water needs. While the Clean Water Act focuses on water quality and not on the quantity of water, clean water still benefits the environment. The Endangered Species Act is used to protect endangered species and their habitats. The definition of critical habitat necessarily includes the water quality and quantity needed for the species to recover.[349] Protection of water for these species' habitats means that these areas will be getting the water needed to maintain the ecosystem for the species to recover and survive in the

future. Arizona has several listed threatened and endangered species. Through the Lower Colorado Multi-Species Conservation Program (MSCP) and other MSCPs in the state, Arizona has taken action aimed at recovering listed species and preventing the future listing of other species.[350] At the same time, the Lower Colorado MSCP is committed to accommodating current water diversions and power production, and optimizing opportunities for future water and water development. Given these obligations, those implementing the Lower Colorado MSCP may have difficulty providing the water needed to maintain and restore the habitat and species.

Finally, the Wild and Scenic Rivers Act empowers the federal government to utilize the federal reserved right doctrine to obtain the amount of unappropriated water available at the time of designation to meet the needs of the river's outstandingly remarkable values (ORVs).[351] Depending on the river's ORV, the environment stands to benefit from the federal government's appropriation of an instream flow. If one recognized value of the instream flow is an element of the ecosystem or ecosystem function, this environmental value can be protected against junior water users.

2. Arizona Law

a. Public Trust Doctrine

While states like California and Hawaii have extended the concept of the public trust, Arizona has adhered to a minimalist public trust doctrine. An option for Arizona is liberalizing its definition of public trust values to include environmental needs through the courts or the Arizona Legislature. After a string of cases on the public trust doctrine, the California Supreme Court finally held that the state's version of the doctrine extended to environmental purposes.[352] California courts have created two distinct public trust doctrines: one for aquatic wildlife habitat, and one for wildlife, which make up the "natural resources ***289** of inestimable value to the community as a whole."[353] Though California has taken much of the acknowledgement for this achievement, Hawaii has a broader public trust doctrine than California.[354] Hawaii also recognizes two public trust doctrines: the navigable water public trust, and the water resources public trust, which is based on the state's complex history and Native Hawaiian rights.[355] These doctrines have evolved into a broad ecological public trust favoring public rights over private.[356] Recognizing the scarcity of freshwater in the state, the Hawaii Supreme Court has even held that maintaining waters in their natural state was a distinct use under the water resources trust.[357]

b. Prior Appropriation

Beneficial use is the measure and limit to the use of surface water. If an appropriator is not utilizing his water in a beneficial way, but instead wasting the water, then this is not considered a valid use of an appropriation. However, courts have loosely construed the definition of "waste" in favor of the appropriators, and conservation requirements have been limited.[358] Arizona could try to encourage users to conserve water by giving them the benefit of the conservation. This is an approach taken by California, among others.[359] California allows users to sell conserved water. There were two reasons for allowing this: metropolitan areas could afford to finance conservation programs for irrigators, and water was more economically valuable as an urban use rather than as irrigation.[360] The legislature seemed to foresee the development of markets to meet urban needs without the necessity of building environmentally harmful dams and reservoirs. Section 1011 of the California Water Code provides that "any cessation or reduction" in the use of appropriated water is "deemed equivalent to a reasonable beneficial use of water ... No forfeiture of the appropriative right to the water conserved shall occur ..."[361] The Code defined water conservation as "the use of less water to accomplish the same purpose or purposes of use allowed under the existing appropriative right."[362] California's amended Water Code provides a kind of flexibility to appropriators that is absent in Arizona law. Not only do appropriators have the option to sell water saved due to conservation efforts, but also appropriators can just let the water go back to stream without losing the right. With this change in law, Arizona appropriators could choose to make their rights available for purchase by conservation advocates or leave water in streams longer than five years. Environmental water needs in Arizona would benefit from a similar change in this state's water laws.

*290 c. Instream Flows

While some modifications need to be made to Arizona's ISF law, the law does recognize the value of instream flows. ISFs directly benefit environmental water needs. If an instream flow is based on wildlife, the water stays in the stream for the sole

benefit of wildlife or, essentially, the environment. Further, Arizona law allows individuals and nongovernment entities such as the Nature Conservancy to apply for new ISF rights. Alaska and Nevada are the only other states that permit this.[363] While Arizona law does allow anyone to acquire an instream flow appropriation, the law only allows the state or one of its political subdivisions to hold severed and transferred ISF rights. This means that an appropriator can sever the water rights from their lands and transfer the water rights to the state or its political subdivisions for recreation and wildlife purposes, among others.[364] This is a limitation in Arizona ISF law that could be changed through legislative action. For instance, the law could be changed to allow individuals to hold severed and transferred water rights for ISF purposes.

d. Minimum Flows

As another option, the Arizona Legislature could pass a law that would allow the state government to establish minimum water flows or levels. Several states including California and Washington have done so. For instance, Washington places a special emphasis on protecting instream and natural values and rights.[365] Washington allows its Department of Ecology to establish minimum water flows or levels to protect fish, game, birds or other wildlife resources, or recreational or aesthetic values, whenever it appears to be in the public interest to do so.[366] The Washington Department of Ecology also has the power to establish minimum flows or levels to protect the water resource or preserve the water quality. What is unique about Washington is that the legislature passed a law requiring the Department of Ecology to establish, in cooperation with Indian tribes and the Department of Fish and Wildlife, a statewide list of priorities for the evaluation of instream flows.[367] The main goal of this law was to foster wild salmonid reproduction. This sort of minimum flow law is just another example of a possible beneficial change that can be implemented in Arizona.

e. Groundwater

The Governor's Water Management Commission's Final Report in 2001 recommended an amendment to Arizona's law that would require the legislature to develop a list and maps that would delineate designated riparian protection zones within the Active Management Areas, with a proposed map included in the report. The identification of these "designated riparian area protection zones" would be legislatively adopted and would be ***291** "based on a half-mile buffer zone adjacent to specified stream segments or cienegas within an AMA."[368] The AWPF would be given the list of designated riparian zones for review and to recommend modifications, through a public process, to the legislature.[369] None of these recommendations have ever been incorporated into Arizona law.

After delineating by statute these designated riparian zones, there are two possible ways to change Arizona law that could benefit the environment. The first change would be to amend the Arizona Water Code to prevent certain new wells from being drilled within designated riparian area protection zones located within AMAs.[370] Instead of outright banning wells in these zones, another option would be a requirement that the Director of ADWR adopt rules to establish criteria determining whether a proposed well in a designated riparian zone would adversely impact the riparian area.[371] Both of these rules would apply to both non-exempt and exempt wells (exempt wells are wells with a maximum pump capacity of thirty-five gallons per minute or less). Preventing wells from being drilled in areas within a specified distance from "designated riparian area protection zones" would alleviate the danger of the AWS rules' depth-to-water standards. Another way to alleviate the danger of the combined impact of exempt wells would be to change the exempt well statutes.[372] The GWMC first recommended that new exempt wells should have a maximum pump capacity of twenty gallons per minute, instead of thirty-five gallons per minute, although its recommendation would exempt higher flow rates if there was a demonstrated need.[373] A second recommendation related to exempt wells within the service area of a water provider or other groundwater withdrawal authority.[374] Under this recommendation, an entity could not drill a new exempt well in a municipal provider service area unless that entity had been denied service from the provider.

Because groundwater pumping affects many Arizona streams and riparian areas, these changes in the law could slow down, or even reverse, degradation caused by groundwater pumping.

f. Other Programs

The Arizona Water Protection Fund, as mentioned before, is an ad hoc program that works from the bottom up. Interested groups must approach the AWPF Commission with a program or management plan in mind that would help a riparian zone.

Despite its bottom up organization, AWPF has been able to fund successful riparian habitat ***292** rehabilitation projects,[375] and it would be a benefit to provide more funding for AWPF. A reduction in funding to AWPF would likely limit efforts to restore and protect riparian areas.

B. Voluntary Transactions

In addition to continuing existing programs and making changes to state law, it is important that full exploration be given to encouraging voluntary arrangements that address environmental water needs. Although a full discussion of voluntary programs is beyond the scope of this paper, a few options are discussed. Just as developers have bought water rights from farmers for human uses, NGOs have attempted to sever and transfer water rights to instream flows. Another ongoing effort is the University of Arizona's Water Resources Research Center's Conserve to Enhance mechanism, which connects individual water conservation with environmental concerns to create funds that will be used to purchase water for the environment.[376]

Through Conserve to Enhance, municipal water customers have the option of donating the money saved through their own water conservation efforts to a fund that would purchase water supplies for environmental enhancement projects. Funds collected may be used for the purchase or leasing of instream flow rights or water transfers. This program is designed to build upon the motivation of individuals who would like their water conservation to yield environmental benefits. The voluntary program is still in the pilot stages and will first be launched in Tucson. Participants must agree to make a monthly donation to the Conserve to Enhance Program based on the money saved from their water bill. The Conserve to Enhance Program therefore provides a way for members of the community to take part in conservation that will directly help the environment.

CONCLUDING REMARKS

As a state known for its physical beauty, Arizona's environment is an asset that must be considered as we grow. In order to avoid further environmental degradation as Arizona water demands continue to grow, it is important to maintain existing legal and institutional options and develop new options for environmental preservation, restoration, and enhancement. To examine how the environment is considered and how it is "forgotten" or overlooked in Arizona water law and policy, it was necessary to examine the history and status of present water law. As this paper illustrates, there is very limited recognition of environmental water needs incorporated into Arizona law. Furthermore, disincentives to ***293** voluntary water transactions that could have environmental benefits are widespread. Given the status of Arizona water law and the limited likelihood of significant changes in the near term, an important next step in supporting voluntary efforts to bring the environment to the table as a water-using sector is describing Arizona's environmental water needs. Coupling the legal analysis with a quantification of environmental water needs will increase the chances that the environment is included in regional and statewide efforts to meet Arizona's future water needs.[377]

Footnotes

a1 Sharon B. Megdal is the Director of the University of Arizona Water Resources Research Center and C.W. and Modene Neely Endowed Professor for Excellence in Agriculture and Life Science. She is Professor in the Department of Agricultural and Resource Economics and the Department of Soil, Water, and Environmental Science and also serves as Director of The University of Arizona Water Sustainability Program.

aa1 Joanna Nadeau is Research Analyst at the University of Arizona Water Resources Research Center

aaa1 Tiffany Tom is a third-year student at the University of Arizona James E. Rogers College of Law.
This work was supported by the University of Arizona Technology & Research Initiative Fund (TRIF), Water Sustainability Program, through the Water Resources Research Center. We are very grateful to the following for their comments on earlier drafts or for providing much needed information on certain parts of the paper: Aaron Citron; Dan Haas for providing input on Wild and Scenic Rivers; Mark McGinnis; Janet Ronald for input on instream flows in Arizona; John Weldon; and John Keane and Rita Maguire for providing input on the Arizona Water Protection Fund. Their comments were invaluable. Any and all errors are those of the authors. information on certain parts of the paper: Aaron Citron; Dan Haas for providing input on Wild and Scenic Rivers; Mark McGinnis; Janet Ronald for input on instream flows in Arizona; John Weldon; and John Keane and Rita Maguire for

providing input on the Arizona Water Protection Fund. Their comments were invaluable. Any and all errors are those of the authors.

[1] Riparian areas occur near bodies of water and are dependent on perennial and intermittent waters. These areas support a great diversity of plants and wildlife. George Zaimes, *Defining Arizona's Riparian Areas and Their Importance to the Landscape*, *in*UNDERSTANDING ARIZONA'S RIPARIAN AREAS 1 (George Zaimes, ed., 2007) [hereinafter UNDERSTANDING ARIZONA'S RIPARIAN AREAS], *available at* http://cals.arizona.edu/pubs/natresources/az1432.pdf.

[2] Arizona participated in a U.S. Environmental Protection Agency (EPA) ecological assessment of all Western waterways. The assessment had two specific goals: (1) develop a report on the ecological condition of all Western perennial waterways, except the "Great Rivers," such as the Colorado River; (2) identify and rank the importance of chemical, physical, and biological disturbances that affect waterway condition. A.T. ROBINSON ET AL., ECOLOGICAL ASSESSMENT OF ARIZONA'S STREAMS AND RIVERS, 2000-2004 v, vii, 7 (Arizona Game and Fish Department Research Branch 2006) [hereinafter Ecological Assessment]. To assist the state, the Arizona Game and Fish Department, U.S. Geological Survey, University of Arizona, Lockheed Martin, and EPA collected the necessary information from forty-seven perennial stream locations in Arizona. This study was conducted to determine the ecological integrity of Arizona's streams and rivers. Sites were sampled and data was collected for different biological, chemical, and physical components. To determine the biotic integrity of different types of aquatic vertebrate (e.g., fish and amphibians) and macroinvertebrate communities (e.g., larval insects, worms, and crustaceans), the study used indexes of biological integrity (IBI), which was developed by the EPA. An IBI is the "sum of several individual measures into a total score, which measures the capability of a community of organisms to support and maintain a balanced community with species composition, diversity, and functional organization comparable to that of least-disturbed habitat [in] a region." IBI was used because the condition of biotic communities in rivers and streams is an indicator of the ecological condition of those water bodies. *Id.* at 9. The study determined that seventy percent of Arizona's streams and rivers were in the most-disturbed condition based on an aquatic vertebrate IBI, and 57% were in the most-disturbed condition based on a macroinvertebrate IBI. *Id.* at 17.

[3] ROBINSON ET AL., *supra* note 2, at 22, 26.

[4] Anthony J. Krzysik, *Biodiversity in Riparian Communities and Watershed Management*, *in*WATERSHED PLANNING AND ANALYSIS IN ACTION 533, 546 (1990), *available at* web.me.com/tatkins1943/pramalastoasis/Exhibits/Exhibit% 20O13.pdf. *See also* Dales S. Turner & Michael D. List, *Habitat Mapping and Conservation Analysis to Identify Critical Streams for Arizona's Native Fish*, 17 AQUATIC CONSERVATION: MARINE AND FRESHWATER ECOSYSTEMS 737 (2006)) (analyzing several causes for the decline of Arizona's native fish populations and identifying conservation priorities).

[5] Krzysik, *supra* note 4, at 537, 546; Turner & List, *supra* note 4.

[6] Environmental water needs specifically means the water needed to sustain a local ecosystem, which includes both the quantity and quality of water necessary to support an ecosystem.

[7] TIM DAVIE, FUNDAMENTALS OF HYDROLOGY 5 (2008); *See*PAUL A. DEBARRY, WATERSHEDS: PROCESSES, ASSESSMENT, AND MANAGEMENT 56 (2004).

[8] 2 ROBERT BECK, *Waters and Water Rights* § 22.06 (3d ed. 2009).

[9] *Id.*

[10] ROBERT GLENNON, WATER FOLLIES: GROUNDWATER PUMPING AND THE FATE OF AMERICA'S FRESH WATERS 42 (2002) [hereinafter WATER FOLLIES].

[11] Mary Nichols, *Hydrologic Processes in Riparian Areas*, *in*UNDERSTANDING ARIZONA'S RIPARIAN AREAS 31.

[12] *Sonoran Desert: Overdraft*, ARID LANDS INFO. CENTER http://alic.arid.arizona.edu/sonoran/documents/nabhan/db_groundwater.html (last visited Mar. 20, 2011); *Overview of the Arizona Groundwater Management Code*, ARIZ. DEP'T OF WATER RESOURCES, http://www.azwater.gov/AzDWR/WaterManagement/documents/Groundwater_Code.pdf (last visited Mar. 20, 2011).

[13] 1 ARIZ. DEP'T OF WATER RES., ARIZONA WATER ATLAS 50 (2010) [hereinafter ARIZONA WATER ATLAS].

[14] George Zaimes, *Human Alterations to Riparian Areas*, *in*UNDERSTANDING ARIZONA'S RIPARIAN AREAS 88; Jeanmarie Haney, *Rivers and Water Management in the Southwest*, SOUTHWEST HYDROLOGY, May-June 2007, at 22.

[15] Zaimes, *supra* note 14, at 87.

[16] ARIZONA WATER ATLAS, *supra* note 13, at 71.

[17] Zaimes, *supra* note 1, at 7.

[18] *Chapter 1: Defining Arizona's Riparian Areas and their Importance to the Landscape*, ARIZONA'S RIPARIAN AREAS, http://cals.arizona.edu/extension/riparian/chapt1/p3.html (last updated May 25, 2006), *Riparian Definitions*, ARIZ.'S RIPARIAN AREAS, http:// cals.arizona.edu/extension/riparian/chapt1/table.html (last visited Apr. 24, 2011). Although there may be differing definitions, riparian areas are defined as areas that occur near a water body and are dependent on perennial and intermittent water. They do not have clearly defined boundaries. Zaimes, *supra* note 1, at 7. In Arizona, a riparian zone is defined as "a geographically delineated area with distinct resource values, that is characterized by deep-rooted plant species that depend on having roots in the water table or its capillary zone and that occurs within or adjacent to a natural perennial or intermittent stream channel or within or adjacent to a lake, pond, or marsh bed maintained primarily by natural water sources." ARIZ. REV. STAT. § 45-101(7) (2010) (this section discusses definitions for the purposes of the Arizona Department of Water Resources).

[19] Zaimes, *supra* note 1, at 1.

[20] *Id.* at 2.

[21] *Id.* at 3.

[22] *Id.*

[23] *Id.*

[24] KIRSTINE E. RANDALL, DEVELOPMENT OF A REVEGETATION PLAN FOR A DESERT RIPARIAN AREA IN ARIZONA 72, available at http://images.library.wisc.edu/EcoNatRes/EFacs/Wetlands/Wetlands18/reference/econatres.wetlands18.krandall.pdf. *See generally* Krzysik, *supra* note 4; Turner & List, *supra* note 4 (analyzing several causes for the decline of Arizona's native fish populations and identifying conservation priorities).

[25] Krzysik, *supra* note 4, at 546. *See also* Turner & List, *supra* note 4, at 739, 743.

[26] Chris Avery et al., *Good Intentions, Unintended Consequences: The Central Arizona Groundwater Replenishment District*, 49 ARIZ. L. REV. 339, 339-40 (2007) (describing the unintended consequences of the Central Arizona Groundwater Replenishment District); *Arizona's Water Supplies and Water Demands*, ARIZ. DEP'T WATER RESOURCES, http://www.azwater.gov/AzDWR/PublicInformationOfficer/documents/supplydemand.pdf (last visited Apr. 25, 2011) [hereinafter

Arizona's Water Supplies]; ARIZONA WATER ATLAS, *supra* note 13.

27 "[R]enewable resources are flow- or rate-limited, [while] nonrenewable resources are stock-limited" and can be depleted without being replenished on a reasonable timescale. Water exhibits both of these characteristics. Surface water is often treated as a renewable resource, while groundwater is treated as a nonrenewable resource. *See* Peter H. Gleick & Meena Palaniappan, *Peak Water Limits to Freshwater Withdrawal and Use*, 107 PROC. OF THE NAT'L ACAD. OF SCI. OF THE U.S. 11,155, 11,156-57 (2010).

28 ARIZONA WATER ATLAS, *supra* note 13, at 50 (Figure 1-23 Average Annual Water Supplies Utilized in Arizona, 2001-2005 in acre-feet and percent of total) (ADWR uses the term cultural water demand, which is "the quantity of water diverted from streams, reservoirs and springs; pumped from wells; or treated wastewater delivered for municipal, industrial and agricultural purposes); Sharon B. Megdal, *Securing Sustainable Water Supplies in Arizona*, U. ARIZ. WATER RESOURCE RES. CENTER, 2 (2004), http:// ag.arizona.edu/azwater/publications.php?rcd_id=21; *Arizona's Water Supplies*, *supra* note 26 (Groundwater is water located "beneath the earth's surface in natural reservoirs called aquifers").

29 ARIZONA WATER ATLAS, *supra* note 13, at 50.

30 *Id.*

31 Janick F. Artiola et al., Arizona: Know Your Water: A Consumer's Guide to Water Sources, Quality, Regulations, and Home Water Treatment Options, U. Ariz., 16 (2004), http:// wsp.arizona.edu/sites/wsp.arizona.edu/files/uawater/documents/AZKYW/AZKnowYourWaterII_ high.pdf. The CAP is a 336-mile canal that withdraws water from the Colorado River at the western edge of Arizona to Phoenix and then south to Tucson. Arizona's Water Supplies, supra note 26.

32 Artiola et al., *supra* note 31. Effluent is defined as "water that has been collected in a sanitary sewer for subsequent treatment in a facility that is regulated pursuant to title 49, chapter 2 [of the Arizona Revised Statutes]. Such water remains effluent until it acquires the characteristics of groundwater or surface water." ARIZ. REV. STAT. § 45-101(4) (2010).

33 Zaimes, *supra* note 1, at 16.

34 *Id.*

35 *Id.*

36 *Id.*

37 *Id.* at 23.

38 *Id.*

39 ARIZ. DEP'T OF WATER RES., DRAFT DEMAND AND SUPPLY ASSESSMENT, 1985-2025: TUCSON ACTIVE MANAGEMENT AREAAA (2010), *available at* http:// www.azwater.gov/AzDWR/documents/FINAL%20TAMA%20ASSESSMENT.pdf [hereinafter DRAFT DEMAND AND SUPPLY ASSESSMENT].

40 *Id.*

[41] ADWR's AMA Assessment is the precursor to the Fourth Management Plan, which is required by the Arizona Groundwater Code. ARIZ. REV. STAT. § 45-567 (2010) (the Fourth Management Plan covers the period of 2010 to 2020); *Water Management*, ARIZ. DEP'T OF WATER RES., http:// www.azwater.gov/AzDWR/WaterManagement/Assessments/default.htm (last visited Mar. 19, 2011) (the AMA Assessment is a compilation of twenty-two years of water demand and supply data that is broken into three major water use sectors--municipal, industrial and agricultural--in each AMA. The purpose of the Assessment is to determine water use trends and identify possible future directions for water management in the Fourth Management Plan).

[42] DRAFT DEMAND AND SUPPLY ASSESSMENT, *supra* note 39, at 12.

[43] *Id.* Evapotranspiration may be broadly defined as all water lost to the atmosphere from the ground surface. However, given the way that the term is used by ADWR, evapotranspiration should be understood as the release of water from plant leaves. *See The Water Cycle: Evapotranspiration*, U.S. GEOLOGICAL SURVEY, http:// ga.water.usgs.gov/edu/watercycleevapotranspiration.html (last visited Mar. 19, 2011).

[44] Adell Louise Amos, *The Use of Instream Flow Laws for Federal Lands: Respecting State Control While Meeting Federal Purposes*, 36 ENVTL. L. 1237, 1241, n.13 (2006).

[45] *See, e.g.*, ARIZ. REV. STAT. § 45-152 (2010).

[46] U.S. CONST. art. VI, cl. 2 ("[t]his Constitution, and the Laws of the United States which shall be made in Pursuance thereof; ... shall be the supreme Law of the Land"); Gibbons v. Ogden, 22 U.S. (9 Wheat.) 1, 210-11 (1824). *See also*Perez v. Campbell, 402 U.S. 637 (1971); Lee v. Florida, 392 U.S. 378 (1968); Nash v. Fla. Industrial Comm'n., 389 U.S. 235 (1967); Hill v. Florida *ex rel.* Watson, 325 U.S. 538 (1945); Amy K. Kelley, *Federal Preemption and State Law*, 105 J. CONTEMP. WATER RES. & EDUC. 4 (1996), *available at* http://www.ucowr.org/updates/pdf/V105_A2.pdf.

[47] U.S. CONST. art. I, § 8 cl. 2; Gilman v. Phila., 70 U.S. 713, 717 (1865); United States v. Rands, 389 U.S. 121, 122-23 (1967); PAMELA BALDWIN, CRS REPORT FOR CONGRESS: THE WILD AND SCENIC RIVERS ACT AND FEDERAL WATER RIGHTS CRS-3 (2001), *available at* http:// ncseonline.org/NLE/CRSreports/08Feb/RL30809.pdf.

[48] 207 U.S. 564 (1908). The doctrine was extended to non-Indian federal lands. *See*Arizona v. California, 373 U.S. 546 (1963), modified, 376 U.S. 340 (1964), modified, 383 U.S. 268 (1966), modified, 466 U.S. 144 (1984), modified, 530 U.S. 392 (2000), and modified, 531 U.S. 1 (2000).

[49] Nevada v. United States, 463 U.S. 110, 117 (1983); Cappaert v. United States, 426 U.S. 128, 138 (1976) (citing the long-established rule that the reservation of water rights is a constitutional right empowered by the Commerce Clause, which permits federal regulation of navigable streams, and the Property Clause, which permits federal regulation of lands); *Winters*, 207 U.S. at 577.

[50] United States v. Adair, 723 F.2d 1394 (9th Cir. 1983) (finding that the primary purposes of the 1864 Klamath Treaty, which created the Klamath Reservation, included the right to hunt, fish, and gather; as a result, there was an implied water rights reservation); Sierra Club v. Watt, 659 F.2d 203, 206 (D.C. Cir. 1981) (finding that water is reserved for the primary purposes of the reservation, not merely for uses that are permissive upon reservation); United States v. New Mexico, 438 U.S. 696, 702 (1978) (clarifying the scope of the Winters Doctrine and finding that water may be reserved only for the primary purposes of the reservation; to reserve water rights for secondary purposes, the federal government must acquire rights through the state's system).

[51] *Winters*, 207 U.S. at 577. *See, e.g., Cappaert*, 42 U.S. at 141 (finding that the purpose of the national monument reservation of Devil's Hole was to preserve "the unusual features of scenic, scientific, and educational interest," and because the pool contained unique desert fish dependent on the pool for spawning, the federal government had a right to unappropriated water. However, the federal government could only obtain rights to the amount of water sufficient to maintain the level of the pool to preserve its scientific value, specifically the desert fish's spawning site.).

[52] *Winters*, 297 U.S. at 577 (noting that "[t]he power of the government to reserve the waters and exempt them from appropriation under the state laws is not denied, and could not be."); Michael C. Blumm, *Reversing the Winters Doctrine?: Denying Reserved Water Rights for Idaho Wilderness and Its Implications*, 73 U. COLO. L. REV. 173, 174 (2002).

[53] *Federal Reserved Water Rights*, BUREAU OF LAND MANAGEMENT, http:// www.blm.gov/nstc/WaterLaws/fedreservedwater.html (last visited Mar. 19, 2011).

[54] *United States v. New Mexico*, 438 U.S. at 702.

[55] Clean Water Act of 1977, 33 U.S.C.A. § 1251 (1977). The Clean Water Act was largely based on the Federal Water Pollution Control Amendments of 1972 (also known as the original Clean Water Act), Clean Water Act, 33 U.S.C.A. § 1251-1387 (1972). Congress made several major amendments in 1977 and 1987. Clean Water Act, 91 Stat. 1566 (1977); 101 Stat. 7 (1987).

[56] *Clean Water Act*, U.S. ENVTL. PROTECTION AGENCY, http:// www.epa.gov/oecaagct/lcwa.html#Summary (last updated Feb. 23, 2011).

[57] 33 U.S.C.A. § 1362(14) (2010).

[58] JOHN W. JOHNSON, UNITED STATES WATER LAW: AN INTRODUCTION 76 (2009).

[59] *Id.* at 77.

[60] 33 U.S.C.A. § 1311(B)(2)(E) (2010), FWPCA § 301; JOHNSON, *supra* note 58, at 77.

[61] *See*33 U.S.C.A. § 1314 (2000) (2010); 40 C.F.R. § 423, app. A (2006).

[62] 33 U.S.C.A. § 1341 (2010).

[63] Wastewater is generally treated water that is discharged from sewage treatment plants. DEBARRY, *supra* note 7, at 56.

[64] 33 U.S.C.A. § 1288 (2010).

[65] JOHNSON, *supra* note 58, at 79.

[66] Clean Water Act, 91 Stat. 1566 (1977).

[67] 16 U.S.C. §§ 1531-1544 (2010); COMMITTEE ON SCIENTIFIC ISSUES IN THE ENDANGERED SPECIES ACT, NAT'L RESEARCH COUNCIL, SCIENCE AND THE ENDANGERED SPECIES ACT 1 (National Academies Press 1995), *available at* http:// books.nap.edu/catalog.php?record_id=497 8. Although the ESA is usually the most powerful form of protection for threatened and endangered species and their habitats, the ESA has some limitations. *See* 1 THE ENDANGERED SPECIES ACT AT THIRTY: RENEWING THE CONSERVATION PROMISE (Dale D. Goble et al., eds., 2007) [hereinafter THE ENDANGERED SPECIES ACT AT THIRTY].

[68] 16 U.S.C. § 1533; LAWRENCE R. LIEBESMAN & RAFE PETERSEN, ENDANGERED SPECIES DESKBOOK 9 (2d ed. 2010). According to NOAA, "An anadromous fish, born in fresh water, spends most of its life in the sea and returns to fresh water to spawn. Salmon, smelt, shad, striped bass, and sturgeon are common examples." *NEFSC Fish FAQ*, NORTHEAST FISHERIES

SCIENCE CENTER, http:// www.nefsc.noaa.gov/faq/fishfaq1a.html (last updated Nov. 24, 2004).

[69] 16 U.S.C. § 1531(b); Kieran F. Suckling & Martin Taylor, *Critical Habitat and Recovery*, *in*THE ENDANGERED SPECIES ACT AT THIRTY.

[70] 50 C.F.R. § 17.11 (2011); *Endangered Species Program*, U.S. FISH AND WILDLIFE SERVICE, http://www.fws.gov/endangered/ (last updated Apr. 13, 2011) (the FWS maintains a worldwide list of endangered species).

[71] *See* U.S.C.A. § 1538 (2010).

[72] 16 U.S.C. § 1531(b) (2006); Suckling & Taylor, *supra* note 69, at 75.

[73] 16 U.S.C. § 1532(5)(a)(i) (2006).

[74] 50 C.F.R. §§ 424.12(b)(2), (4) (2010).

[75] 50 C.F.R. § 424.12(b) (2006).

[76] 16 U.S.C. § 1538(a) (2006). The term "take" means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." 16 U.S.C. § 1532(19).

[77] 50 C.F.R. § 17.3 (2004).

[78] Babbitt v. Sweet Home Chapter of Cmtys. for a Great Or., 515 U.S. 687, 708 (1995); THE ENDANGERED SPECIES ACT: PRIMER, EVALUATION AND PROSPECTS 89 (Harold B. Carleton Jr. ed., 2009). *See*PAMELA BALDWIN, HABITAT MODIFICATION AND THE ENDANGERED SPECIES ACT: THE SWEET HOME DECISION CRS Report 95-778 (1996).

[79] As a result of several species' designations in Arizona, the DOI agencies collaborated with other stakeholders to develop the Lower Colorado River Multi-Species Conservation Program (MSCP) with three specific goals: (1) conserve habitat, recover threatened and endangered species, and prevent the future listing of species; (2) accommodate present water diversions and power production and optimize opportunities for future water and power development, consistent with the law; and (3) provide the basis for incidental take authorizations. If successful, the protection of endangered species, triggered by the ESA, will directly help safeguard the critical habitat of four species and will prevent the future listing of sixteen species. Vol. 2 Lower Colorado River Multi-Species Conservation Program: Final Habitat Conservation Plan, 1-3 (2004), *available at* http://www.lcrmscp.gov/publications/VolumeII.pdf.

[80] *See*16 U.S.C.A. § 1533 (2010) (determining whether a species is an endangered species or a threatened species).

[81] *Id.*

[82] 16 U.S.C. § 1271 (2006)

[83] 16 U.S.C. § 1286(b) (2006).

[84] 16 U.S.C. § 1271 (2006). The WSRA does not further define ORVs. The only guidance provided to administrators is Section 101 which advises administrators to place primary emphasis on a river's aesthetic, scenic, historic, archaeological and scientific

features. 16 U.S.C. § 1281(a). However, the Interagency Wild and Scenic Rivers Coordinating Council released a guideline on Section 5, which directs federal agencies to evaluate rivers as potential additions to the National System. In this guideline, the Interagency defines an ORV as a river-related value that is a "unique, rare or exemplary feature that is significant at a comparative regional or national scale. Dictionary definitions of the words 'unique' and 'rare' indicate that such a value would be one that is a conspicuous example from among a number of similar values that are themselves uncommon or extraordinary." 16 U.S.C. § 1276(d) (2006); INTERAGENCY WILD AND SCENIC RIVERS COORDINATING COUNCIL, THE WILD AND SCENIC RIVER STUDY PROCESS 12 (1999); Friends of Yosemite Valley v. Norton, 194 F. Supp. 2d 1066, 1086 (E.D.Cal. 2002), *affirmed in part, reversed in part* 348 F.3d 780, *opinion clarified*366 F.3d 731,*on remand*439 F. Supp. 2d 1074 (finding that the National Park Service's definition of an ORV as a "unique, rare or exemplary feature that is significant at a comparative regional or national scale" was not arbitrary or capricious).

85 16 U.S.C. § 1273(b) (2006).

86 16 U.S.C. § 1273(a) (2006).

87 16 U.S.C. § 1273 (2006).

88 INTERAGENCY WILD AND SCENIC RIVERS COORDINATING COUNCIL, IMPLEMENTING THE WILD & SCENIC RIVERS ACT: AUTHORITIES AND ROLES OF KEY FEDERAL AGENCIES 1, *available at* http://www.rivers.gov/publications/federal-agency-roles.pdf (this paper was developed to "help the staff from river-administering and key federal agencies understand the various authorities and better coordinate agency roles in river protection.").

89 INTERAGENCY WILD AND SCENIC RIVERS COORDINATING COUNCIL, WATER QUANTITY AND QUALITY AS RELATED TO THE MANAGEMENT OF WILD & SCENIC RIVERS 1 (2003).

90 16 U.S.C. § 1273; Wild & Scenic Rivers Act, 16 U.S.C. §§ 1271-72 (1968), *available at* http://www.ferc.gov/legal/fed-sta/wsr-act.pdf;
Section 1 of WSRA; 18 USCA § 1284; Potlatch Corp. v. United States, 12 P.3d 1256, 1258 (Idaho 2000) (holding that Congress intended, by way of Section 13(c), to reserve water to fulfill the WSRA's purposes); KRISTINA ALEXANDER, CONG. RES. SERV., RL30809 THE WILD AND SCENIC RIVERS ACT AND FEDERAL WATER RIGHTS 11 (2007), *available at* www.rivers.gov/publications/crswaterrights.pdf; telephone interview with Dan Haas, Mid-Columbia NWR Complex Planner, U.S. FWS in Burbank, Wash. (July 29, 2010).

91 *Potlatch Corp.*, 12 P.3d at 1258 (holding that Congress intended, through Section 13(c), to reserve water to fulfill the WSRA's purposes); ALEXANDER, *supra* note 90, at 2; telephone interview with Dan Haas, Mid-Columbia NWR Complex Planner, U.S. FWS in Burbank, Wash. (July 29, 2010).

92 114 Cong. Rec. 26,594 (1968) (statement of Rep. Wayne N. Aspinall, quoting the DOI: "[E]nactment of the bill would reserve to the United States sufficient unappropriated water flowing through Federal lands involved to accomplish the purpose of the legislation. Specifically, only that amount of water will be reserved which is reasonably necessary for the preservation and protection of those features for which a particular river is designated in accordance with the bill. It follows that all unappropriated and unreserved waters would be available for appropriation and use under State law for future development of the area.").

93 *See Winters*, 207 U.S. 564, 577.

94 CYNTHIA BROUGHER, CONG. RES. SERV., RL30809 THE WILD AND SCENIC RIVERS ACT AND FEDERAL WATER RIGHTS 10 n.25 (2008) ("circumstances may arise in which the United States may be obliged to rely on the federal reserved right, as in a general water adjudication [per the McCarran Amendment] or to carry out the federal purposes if no other means are available"), *available at* http:// digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1019&context=crsdocs.

95 *Id.* at 10.

[96] 16 U.S.C. § 1284(d) (2006) (preserving the state's jurisdiction over the waters of any stream that is included in a National System); Grand Canyon Dories, Inc. v. Idaho Outfitters & Guides Bd., 709 F.2d 1250, 1256 (9th Cir. 1983). *See infra* Part V(B)(i).

[97] Michael C. Blumm, *Reversing the Winters Doctrine?: Denying Reserved Water Rights for Idaho Wilderness* 73 U. COLO. L. REV. 173, 178 (2002).

[98] Arizona instream flow applications may also take a long time as well.

[99] *Id.* The downstream users affected by the WSRA water right would have to be taking their water at a point within the portion of the river that is protected under the WSRA. If this is a downstream user located outside of the designated portion of the river, then the downstream user would be the recipients of instream flows that are "pulled" through the Wild and Scenic River. *See* email with Dan Haas, Mid-Columbia NWR Complex Planner, U.S. FWS in Burbank, Wash. (Oct. 22, 2010).

[100] JOSEPH L. SAX, BARTON H. THOMPSON, JR., JOHN D. LESHY & ROBERT H. ABRAMS, LEGAL CONTROL OF WATER RESOURCES: CASES AND MATERIALS 671 (4th ed. 2006).

[101] *Id.* at 672; Brian E. Gray, *No Holier Temples: Protecting the National Parks Through Wild and Scenic River Designation*, 58 U. COLO. L. REV. 551, 579 (1988).

[102] 18 U.S.C. § 1284(b) (2006).

[103] ALEXANDER, *supra* note 90, at 7.

[104] Public Land Management Act of 2009, Pub. L. No. 111-11, 123 Stat. 991; Wilderness Act of 1984, Pub. L. No. 98-406, 98 Stat. 1485.

[105] *Fossil Creek*, NAT'L WILD & SCENIC RIVERS, http:// www.rivers.gov/wsr-fossil.html (last visited Apr. 4, 2011).

[106] *River Mileage Classifications for Components of the National Wild and Scenic Rivers System*, NAT'L WILD & SCENIC RIVERS (June 2009), http:// www.rivers.gov/publications/rivers-table.pdf.

[107] *Id.*

[108] Ill. Cent. R.R. Co. v. Ill., 146 U.S. 387, 452-53, 455 (1892) (known as the seminal case to establish the public trust doctrine as part of federal common law); Timothy M. Mulvaney, *Instream Flows and the Public Trust*, 22 TUL. ENVTL. L.J. 315, 344 (2009). *See generally*Ariz. Ctr. for Law in Pub. Interest v. Hassell, 837 P.2d 158, 166 (Ariz. App. 1991); Robin Kundis Craig, *A Comparative Guide to the Western States' Public Trust Doctrines: Public Values, Private Rights, and the Evolution Toward an Ecological Public Trust*, 37 ECOLOGY L.Q. 53 (2010) (provides an in-depth discussion on the public trust doctrine in the western United States); Timothy M. Mulvaney, *Instream Flows and the Public Trust*, 22 TUL. ENVTL. L.J. 315, 345-50 (2009) (provides an in-depth discussion on the origins of the public trust doctrine).

[109] Tracy Dickman Zobenica, Note, *The Public Trust Doctrine in Arizona's Streambeds,* 38 ARIZ. L. REV. 1053, n.8 (1996); Craig, *supra* note 108, at 71.

[110] ARIZ. REV. STAT. § 37-1101(8) (2010); State *ex rel.* Winkleman v. Ariz. Navigable Stream Adjudication Comm'n, 229 P.3d 242, 247, note 4 (Ariz. App. 2010); *Ariz. Ctr. for Law in the Pub. Interest*, 837 P.2d at 166-68;Maricopa Cnty. Mun. Water

Conservation Dist. No. 1 v. Sw. Cotton Co., 4 P.2d 369, 372 (Ariz. 1931), *reh'g denied and opinion modified*, 7 P.2d 254 (1932) (recognized the public trust doctrine in Arizona, by establishing that "[n]avigable waters were, under the common law, considered as under the exclusive control of the government, in trust for the general public, so far as the rights of navigation, etc., were concerned ..."); Douglas L. Grant, *Underpinnings of the Public Trust Doctrine: Lessons From Illinois Central Railroad*, 33 ARIZ. ST. L.J. 849 (2001).

111 Ill. Cent. R.R. v. Illinois, 146 U.S. 387, 453 (1892).

112 *Winkleman*, 229 P.3d at 247, note 4;*Ariz. Ctr. for Law in the Pub. Interest*, 837 P.2d at 168.

113 Carol Rose, *Joseph Sax and the Idea of the Public Trust*, 25 ECOLOGY L.Q. 351 (1998). An easement is an interest in land consisting in the right to use or control the land for a specific limited purpose, in this case, for public purposes. BLACK'S LAW DICTIONARY 226 (2d pocket ed. 2001).

114 Craig, *supra* note 108, at 70. *See Ill. Cent. R.R.*, 146 U.S. at 452-53;Defenders of Wildlife v. Hull, 18 P.3d 722, 726-38 (Ariz. App. 2001).

115 *Id.* at 82. *See generally* Joseph L. Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471 (1970) (widely regarded as the seminal article that instigated the rebirth of the public trust doctrine).

116 Craig, *supra* note 108, at 82.

117 William D. Araiza, *Democracy, Distrust, and the Public Trust: Process-Based Constitutional Theory, the Public Trust Doctrine, and the Search for a Substantive Environmental Value* 45 UCLA L. REV. 385, 386 (1997).

118 Craig, *supra* note.108, at 83.

119 *Id.* at 71-72. In contrast to Arizona, Hawaii takes a more liberal view of the doctrine. Recognizing the scarcity of freshwater in the state, Hawaiian courts subordinated private parties to the public interest by authorizing the state to preserve water to benefit the general public. Robinson v. Ariyoshi, 658 P.2d 287, 311-12 (Haw. 1982) (to protect the public interest, the court recognized the need for a common law restraint on the right of private parties to utilize rivers for whatever purpose they saw fit).

120 Craig, *supra* note 108, at 71-72. Pursuant to A.R.S. Section 37-1128, Arizona limits navigable waters, and the application of the public trust doctrine, to the equal footing doctrine. ARIZ. REV. STAT. § 37-1128 (2010); Pollards's Lessee v. Hagan, 44 U.S. 212, 230 (1845) (established the equal footing doctrine by holding that new states have the same rights of sovereignty over [navigable waters] as the original states"); Craig, *supra* note 108, at 63. As successors to England, the original thirteen states acquired title to the beds and banks of navigable waters. Idaho v. U.S., 533 U.S. 262, 272 (2001); And, under the equal footing doctrine, all the other states acquired title upon statehood. *Idaho v. U.S.*, 533 U.S. at 272;*Pollards's Lessee*, 44 U.S. at 230; Craig, *supra* note 108, at 71-72. Thus at the time of statehood in 1912, Arizona assumed title to all navigable waterways.

121 ARIZ. REV. STAT. § 37-1101(6) (2010).

122 ARIZ. REV. STAT. § 37-1101(5).

123 ARIZ. REV. STAT. § 37-1101(9).

124 *See infra* note 146; Craig, *supra* note 108, at 80, 102-04 (Colorado is the only other state besides Arizona to intentionally limit, by case law, the application of the doctrine).

[125] Zobenica, *supra* note 109, at 1055.

[126] ARIZ. REV. STAT. ANN. § 37-1121 (2010).

[127] ARIZ. REV. STAT. § 37-1121; What ANSAC Does and Why, ANSAC WEBSITE, http://www.azstreambeds.com/default.asp.

[128] ARIZ. REV. STAT. ANN. § 37-1128(B) (2010).

[129] ARIZ. REV. STAT. § 37-1129 (2010).

[130] ARIZ. REV. STAT. § 37-1130 (2010).

[131] ARIZ. REV. STAT. § 37-1132 (2010); Craig, *supra* note 108, at 100.

[132] ARIZ. REV. STAT. § 37-1152 (2010).

[133] ARIZ. REV. STAT. § 37-1130 (2010).

[134] *Id.*

[135] S.W. Sand & Gravel, Inc. v. Cent. Ariz. Water Conservation Dist., 212 P.3d 1, 5 (Ariz. Ct. App. 2008); Craig, *supra* note 108, at 102.

[136] S.W. Sand & Gravel, Inc., 212 P.3d at 5.

[137] Nat'l Audubon Soc'y v. Superior Court (*Mono Lake*), 658 P.2d 709, 727 (Cal. 1983). The court did not alter any water rights in this case; instead, it remanded to the superior court, which could also rely on the California Water Resources Board (CWRB) to review Los Angeles's diversion permits in lieu of the public trust doctrine. *Id.* at 732. In 1994, CWRB revised Los Angeles's permits, restricting diversions to restore average water elevation to approximately 6392 feet to protect public trust resources. In re Amendment of Los Angeles's Water Right Licenses, 1994 WL 758358, at * 120 (Cal. Water Res. Bd. 1994).

[138] *Mono Lake*, 658 P.2d at 728. In *State Water Resources Control Board Cases*, 39 Cal.Rptr.3d 189, 272 (Cal. Ct. App. 2006), the court interpreted the meaning of "whenever feasible" in *Mono Lake* and found that the CWRB could approve appropriations of water "despite foreseeable harm to public uses" in light of the State's duty to preserve those uses "so far as consistent with the public interest."

[139] *Mono Lake*, 658 P.2d at 728.

[140] *Id.* at 721.

[141] *Id.* at 728.

[142] ARIZ REV. STAT. § 45-263(B) (1995) (*invalidated* by San Carlos Apache Tribe v. Super. Ct., 972 P.2d 179 (Ariz. 1999).

[143] San Carlos Apache Tribe v. Superior Court, 972 P.2d 179, 199 (Ariz. 1999).

[144] The court explained:
The public trust doctrine is a constitutional limitation on legislative power to give away resources held by the state in trust for its people. The Legislature cannot order the courts to make the doctrine inapplicable to these or any proceedings ..... That determination depends on the facts before a judge, not on a statute. It is for the courts to decide whether the public trust is applicable to the facts. The Legislature cannot by legislation destroy the constitutional limits on its authority.
Id. (citations omitted).

[145] These cases are about the navigability of the Lower Salt River, Upper Salt River, Santa Cruz River, San Pedro River, Verde River, and Gila River. *See* State ex rel. Winkleman v. Ariz. Navigable Stream Adjudication Comm'n, 229 P.3d 242, 257 (Ariz. App. 2010) (vacating the superior court's judgment upholding ANSAC's determination that Lower Salt River was non-navigable at the time of statehood); *Arizona Navigable Stream Adjudication Commission*, ARIZ. NAVIGABLE STREAM ADJUDICATION COMM'N, http:// www.azstreambeds.com/default.asp (last visited Apr. 4, 2011).

[146] ARIZ. REV. STAT. § 37-1128(B).

[147] Irwin v. Phillips, 5 Cal. 140, 145-46 (1855); Eddy v. Simpson, 3 Cal. 249 (1853) (noted as first case to state the doctrine of prior appropriation); 1 ROBERT BECK, *Waters and Water Rights* § 11.02(a) (2009); JOHNSON, *supra* note 58, at 46.

[148] Adams v. Salt River Valley Water Users' Ass'n, 89 P.2d 1060, 1066 (Ariz. 1939); Daggs v. Howard Sheep Co., 145 P. 140, 142 (Ariz. 1914); BECK, *supra* note 147, § 12.02(b).

[149] BECK, *supra* note 147, at § 12.02(b); JOHNSON, *supra* note 58, at 45-46.

[150] ARIZ. CONST., art. XVII, § 1, 2 Howell Code (1864); ARIZ. REV. STAT. § 3198 (1887); Clough v. Wing, 17 P. 453, 456-57 (Ariz. 1888); BECK, *supra* note 147, at § 11.04(a).

[151] Ariz. Const. art. XVII; ARIZ. REV. STAT. § 45-141(A) (2010).

[152] ARIZ. REV. STAT. § 45-141(A).

[153] ARIZ. REV. STAT. § 45-151 (2010).

[154] ARIZ. REV. STAT. § 45-151.

[155] Phelps Dodge Corp. v. Ariz. Dep't of Water Res., 118 P.3d 1110, 1112 (Ariz. App. 2005).

[156] SAX ET AL., *supra* note 100, at 125. There are some exceptions to this general rule; for example, a person may hold water for later use through recharge and recovery. *See*ARIZ. REV. STAT. §§ 45-811.01-45-836.01.

[157] *See infra* Part V(B)(ii).

[158] *In re* Gen. Adjudication of All Rights to Use Water in Gila River Sys. & Source, 35 P.3d 68 (Ariz. 2001), ARIZ. REV. STAT. § 45-151 (2010).

[159] ARIZ. REV. STAT. § 45-151.

[160] ARIZ. REV. STAT. § 45-151.

[161] BECK, *supra* note 147, at § 12.02(e).

[162] ARIZ. REV. STAT. § 45-151.

[163] *See*BECK, *supra* note 147, at § 12.02(c)(2).

[164] *Id.*

[165] Ariz. Pub. Serv. Co. v. Long, 773 P.2d 988, 1007-08 (Ariz. 1989) (Haire, J., concurring in part and dissenting in part).

[166] ARIZ. REV. STAT. § 45-153(A) (2010).

[167] ARIZ. REV. STAT. § 45-153(A).

[168] ARIZ. REV. STAT. § 45-157(A), (B) (2010).

[169] Sasha Charney, *Decades Down the Road: An Analysis of Instream Flow Programs in Colorado and the Western United States*, Colo. Water Conservation Bd. (2005), http://cwcb.state.co.us/NR/rdonlyres/140CFE4B-65FC-47C5-9A26-99CCB45A8D45/0/ISFCompStudyFinalRpt.pdf.

[170] ARIZ. REV. STAT. § 45-151 (2010).

[171] McClellan v. Jantzen, 547 P.2d 494, 496 (Ariz. Ct. App. 1976); 1941 Ariz. Sess. Laws 179.

[172] 1962 Ariz. Sess. Laws 265-266.

[173] *Id.*

[174] Exec. Order No. 91-6, "Protection of Riparian Areas," Feb. 14, 1991.

[175] *Id.*

[176] *Id.*

[177] 118 P.3d 1110 (Ariz. App. 2005). The United States Forest Service applied for a permit to appropriate water from Cherry Creek, which is a tributary of the Salt River. The permit would have granted the USFS the right to instream flows for fish, wildlife, and recreation purposes. The Salt River Project ("SRP") protested on behalf of the Salt River Valley Water User's Association. SRP claimed it had appropriated all normal flow and flood waters of the Salt River, Verde River and their tributaries, which included Cherry Creek. Other parties, including Phelps Dodge, also filed protests. *Id.* at 1111.

[178] *Id.* at 1112. However, the legality of instream flows as a kind of water right has not been entirely resolved. Phelps Dodge was purchased by Freeport McMoRan, and Freeport McMoRan continues to challenge instream flow permits and related issues. This issue may be revived again if and when ADWR finally makes a decision on the pending Sever and Transfer application to instream flow uses in the San Pedro and Verde Rivers.

[179] *Id.*

[180] *Id.* at 1115-16.

[181] *Id.* at 1117.

[182] *See supra* note 155 (referencing the *Phelps Dodge* case, a case which highlights the importance of junior instream flow rights when a senior appropriator wants to change the point of diversion).

[183] *See*ARIZ. DEP'T OF WATER RES., INSTREAM FLOW APPLICATION LIST (Jun. 1, 2010) (on file with author).

[184] *Arizona Water Rights Fact Sheet*, W. STATES WATER LAWS, http:// www.blm.gov/nstc/WaterLaws/arizona.html (last visited Mar. 20, 2011).

[185] ARIZ. REV. STAT. § 45-172(A) (2010).

[186] Personal Communication with Janet Ronald, Deputy Counsel, Ariz. Dep't of Water Res. (Dec. 3, 2010).

[187] Arizona law makes the acquisition of rights for adverse possession available only to rights perfected before May 21, 1974. ARIZ. REV. STAT. § 45-187 (2010). However, the Arizona Supreme Court has found Section 45-187 unconstitutional. San Carlos Apache Tribe v. Superior Court, 972 P.2d 179, 202 (Ariz. 1999).

[188] Phelps Dodge Corp. v. Ariz. Dep't of Water Res., 118 P.3d 1110, 1115 (Ariz. App. 2005); Gila Water Co. v. Green, 241 P. 307, 308 (Ariz. 1925); Gould v. Maricopa Canal Co., 76 P. 598, 601 (Ariz. 1904).

[189] Strawberry Water Co. v. Paulsen, 207 P.3d 654, 661 (Ariz. App. 2008).

[190] ARIZ. REV. STAT. § 45-141(E) (2010). *But see San Carlos Apache Tribe*, 972 P.2d at 202 (finding section 45-189(E)(8)-(12) invalid as sufficient causes for nonuse).

[191] ARIZ. REV. STAT. § 45-188(A) (2010). *But see San Carlos Apache Tribe*, 972 P.2d at 188 (finding the retroactive provisions of Sections 45-188(A)-(B) unconstitutional).

[192] Strawberry Water, 207 P.3d at 660.

[193] *Id.*

[194] ARIZ. REV. STAT. § 45-141(C); Phelps Dodge Corp. v. Ariz. Dep't of Water Res., 118 P.3d 1110, 1115 (Ariz. App. 2005); Gila Water Co. v. Green, 241 P. 307, 308 (Ariz. 1925). Section 45-189(C) also exempts from forfeiture all water rights initiated before

June 12, 1919. ARIZ. REV. STAT. § 45-189(C). But it was found unconstitutional by the Arizona Supreme Court in *San Carlos Apache Tribe*. 972 P.2d at 202 (1999). The interpretation may still be an open question. *Id.* at 190.

195 ARIZ. REV. STAT. § 45-141(C).

196 ARIZ. REV. STAT. § 45-189(E) (2010).

197 ARIZ. REV. STAT. § 45-189. *But see* question of constitutionality for the retroactive provisions, *supra* note 191.

198 *See*Salt River Valley Water Users' Ass'n v. Kovacovich, 411 P.2d 201, 203-04 (Ariz. Ct. App. 1966).

199 Adam Schempp, *Western Water in the 21st Century: Policies and Programs that Stretch Supplies in a Prior Appropriation World*, 40 ENVTL. L. REP. NEWS & ANALYSIS 10394, 10395 (2010).

200 *Id.* at 10395-96.

201 *Id.* at 10396.

202 Aaron Citron, *Working Rivers and Working Landscapes: Using Short-Term Water Use Agreements to Conserve Arizona's Riparian and Agricultural Heritage*, 1 ARIZ. J. OF ENVT'L L. & POL'Y 7, 19-20 (2010).

203 ARIZ. REV. STAT. § 45-141(B) (2010).

204 SAX ET AL., *supra* note 100, at 159.

205 State Dep't of Ecology v. Grimes, 852 P.2d 1044 (Wash. 1993); SAX ET AL., *supra* note 100, at 175.

206 *Id.* at 159.

207 Colorado v. New Mexico, 467 U.S. 310, 319 (1984) (discussing the waste doctrine in the context of an interstate equitable apportionment dispute); SAX ET AL., *supra* note 100, at 168.

208 SAX ET AL., *supra* note 100, at 167.

209 For example, in *U.S. v. Gila Valley Irrigation District*, the Ninth Circuit Court of Appeals held that the Apache Tribe's use of unlined canals was in accord with the general principles of prior appropriation law. 31 F.3d 1428, 1433-34 (9th Cir. 1994). The doctrine of waste will not force change in the efficiency of agricultural irrigation techniques; the change must occur through voluntary action. However, in another case, the Arizona Court of Appeals ruled against the appropriator. Salt River Valley Water Users' Ass'n v. Kovacovich, 411 P.2d 201 (Ariz. App. 1966). In *Kovacovich*, the Court held that an appropriator cannot, through conservation practices, use the water saved on immediately adjacent lands owned by that person. *Id.* at 203. The Court based its decision on the beneficial use doctrine--water rights attach to the land to which the water was originally appurtenant. *Id.* Because *Kovacovich* focused on a narrow issue, an appropriator seeking to use conserved water on adjacent land, *id.* at 203-04, this case does not directly apply to a case in which a landowner has employed conservation mechanisms but intends to keep the full water right.

210 *Application Guidelines: Permit to Appropriate Public Water or To Construct a Reservoir*, ARIZ. DEP'T OF WATER RES., http://

www.azwater.gov/azdwr/SurfaceWater/SurfaceWaterRights/documents/ApplicationPermittoAppropriateISF_ 000.doc (last visited Apr. 4, 2011).

211 Colorado v. New Mexico, 467 U.S. 310, 319 (1984).

212 *Gila Valley Irrigation Dist.*, 31 F.3d at 1434.

213 SAX ET AL., *supra* note 100, at 197.

214 Lambeye v. Garcia, 157 P. 977, 978-79 (Ariz. 1916) (holding that an individual who appropriated wastewater flowing from the premises of another after it had been used had no vested right to the water); SAX, ET AL., *supra* note 100, at 197.

215 Bower v. Big Horn Canal Ass'n, 307 P.2d 593, 601-02 (Wyo. 1957); SAX ET AL., *supra* note 100, at 198-199, note 1.

216 SAX ET AL., *supra* note 100, at 199, note 2.

217 Ariz. Pub. Serv. Co. v. Long, 773 P.2d 988 (Ariz. 1989).

218 *Id.* at 995.

219 *Id.* at 996.

220 *Id.* at 996-97.

221 *Id.* at 997.

222 Andrew Schwarz & Sharon B. Megdal, *Conserve to Enhance: Voluntary Municipal Water Conservation to Support Environmental Restoration*, 100 AM. WATER WORKS ASS'N 42 (2008).

223 U.S. E.P.A., GUIDING PRINCIPLES FOR CONSTRUCTED WETLANDS: PROVIDING FOR WATER QUALITY AND WILDLIFE HABITAT, 2 (2000), *available at* http:// www.epa.gov/owow/wetlands/pdf/constructed.pdf.

224 *Id.*

225 U.S. E.P.A., CONSTRUCTED WETLANDS FOR WASTEWATER TREATMENT AND WILDLIFE HABITAT: 17 CASE STUDIES 10 (Sept. 1993), available at http:// www.epa.gov/owow/wetlands/pdf/Introduction.pdf.

226 *Id.* at 11.

227 *Id.* at 10.

228 *Id.*

229 Thaddeus K. Graczyk, Frances E. Lucy, Leena Tamang, et. al, *Propagation of Human Enteropathogens in Constructed Horizontal*

Wetlands Used for Tertiary Wastewater Treatment 75(13), APPLIED AND ENVIRONMENTAL MICROBIOLOGY 4531, 4535 (2009).

230 U.S. E.P.A., CONSTRUCTED WETLANDS, *supra* note 225.

231 Sharon Megdal et al., *Projects to Enhance Arizona's Environment: An Examination of Their Functions, Water Requirements & Public Benefits*, UNIV. OF ARIZ., I-18 (2006) http://www.google.com/url?sa=t&source=web&cd=2&ved=0CCIQFjAB&url=http%3A%CC2F%CC2Fag.arizona.edu%CC2Fazwater%CC2Ffiles%CC2Fprojectstoenhanceaz%CC255C%C̃.senvironment(bor-megdal)5-10-06section1.pdf&rct=j&q=Projects%20to%CC20enhance%CC20arizona%CC27s%CC20environment%CC2018%%202006&ei=uSadTeCQEeTn0QGHsJW6BA&usg=AFQjCNHf5MGtrnbL2blre7UD7jvO5JTckA&sig2=dkwwFD0aRPY1vxemU0atMA& cad=rja.

232 WATER FOLLIES, *supra* note 10, at 28.

233 During the ice age, the Southwest was covered with lakes. *Id.* The water from the lakes seeped into the ground, collected in aquifers, and became groundwater. *Id.*

234 *Id.*

235 *Id.* at 28-29.

236 *Id.* at 29.

237 Davis v. Agua Sierra Resources L.L.C., 203 P.3d 506, 508 (Ariz. 2009) (citing *In re* General Adjudication of All Rights to Use Water in the Gila River Sys. & Source, 9 P.3d 1069, 1073 (Ariz. 2000)); Town of Chino Valley v. City of Prescott, 638 P.2d 1324, 1328 (Ariz. 1981); Bristor v. Cheatham, 255 P.2d 173, 179 (Ariz. 1953).

238 ARIZ. REV. STAT. § 45-453(1); Town of Chino Valley, 638 P.2d at 1328.

239 *Davis*, 203 P.3d at 508 (citing Howard v. Perrin, 76 P. 460, 462 (Ariz. Terr. 1904)).

240 *Id.* (citing Chino Valley v. Prescott, 638 P.2d 1324, 1328 (Ariz. 1981)). *See also Robert Schaffer,* Davis v. Agua Sierra Resources%i: Bringing Some Clarity to Groundwater Rights in Arizona*, 1 ARIZ. J. OF ENVTL. L. & POL'Y 25 (2010).*

241 *Bristor*, 255 P.2d at 180;*In re* Gen. Adjudication of All Rights to Use Water in Gila River Sys. & Source, 989 P.2d 739, 743, n. 3 (Ariz. 1999).

242 Bristor, 225 P.2d at 180. *See also*Brady v. Abbott Laboratories, 433 F.3d 679 (9th Cir. 2005)

243 *Davis*, 203 P.3d at 508; John D. Leshy & James Belanger, *Arizona Law: Where Ground and Surface Water Meet*, 20 ARIZ. ST. L.J. 657, 659 (1988).

244 ARIZ. REV. STAT. § 45-101(5) (2010).

245 Collier v. Ariz. Dept of Water Res., 722 P.2d 363, 366 (Ariz. App. 1986).

[246] *In re* Gen. Adjudication of All Rights to Use Water in Gila River Sys. & Source (*Gila River IV*), 9 P.3d 1069, 1073 (Ariz. 2000).

[247] Robert Jerome Glennon & Thomas Maddock, *In Search of Subflow: Arizona's Futile Effort to Separate Groundwater from Surface Water*, 36 ARIZ. L. REV. 567, 578 (1994) (giving a detailed and scientific explanation of the cone of depression); 2 ROBERT BECK, *Waters and Water Rights* § 18.02, at 19 (2009).

[248] Glennon, *supra* note 247, at 580.

[249] *Id.*

[250] *Id.* at 581.

[251] Bristor v. Cheatham, 255 P.2d 173 (Ariz. 1953).

[252] Collier v. Ariz. Dept. of Water Resources, 722 P.2d 363, 364-365 (Ariz. App. 1986).

[253] Howard v. Perrin, 76 P. 460, 462 (Ariz. 1904) (first used the term "subterranean streams" for hydrologically connected groundwater); Maricopa Cnty. Mun. Water Conservation Dist. No. 1 v. Sw. Cotton Co., 4 P.2d 369, 380 (Ariz. 1931), (*reh'g denied and opinion modified*), 7 P.2d 254 (1932) (used the term "subflow" to describe such waters).

[254] *Howard*, 76 P. at 462.

[255] Maricopa Cnty. Mun. Water Conservation Dist. No. 1, 4 P.2d at 380.

[256] *In re* Gen. Adjudication of All Rights to Use Water in the Gila River Sys. & Source (*Gila River II*), 857 P.2d 1236 (Ariz. 1993); *In re* Gen. Adjudication of All Rights to Use Water in the Gila River Sys. & Source (*Gila River II*), 857 P.2d 126 (Ariz. 1993). *See* Meredith Marder, *The Battle to Save the Verde: How Arizona's Water Law Could Destroy One of Its Last Free-Flowing Rivers*, 51 ARIZ. L. REV. 175, 191-92 (2009).

[257] *Gila River IV*, 9 P.3d at 1073, 1083.

[258] *Id.* at 1073.

[259] *Id.* at 1080.

[260] *Id.* at 1077. (provides the factors that ADWR must consider in determining the subflow zone).

[261] *In re* Gen. Adjudication of All Rights to Use Water in the Gila River Sys. & Source, No. W-1, W-2, W-3, W-4 (Consolidated), Contested Case No. W1-103 (Ariz. Super. Ct. Maricopa Cnty. filed Jan. 22, 2002) (minute entry); Joseph M. Feller, *The Adjudication that Ate Arizona Water Law*, 49 ARIZ. L. REV. 405, 424 (2007).

[262] *In re* Gen. Adjudication of All Rights to Use Water in the Gila River Sys. & Source, No. W-1, W-2, W-3, W-4 (Consolidated), Contested Case No. W1-103 (Ariz. Super. Ct. Maricopa County filed Sept. 15, 2005), *available at* http:// www.superiorcourt.maricopa.gov/SuperiorCourt/Adjudications/_ ballinger/Subfloword92805.pdf.

[263] *In re* Gen. Adjudication of All Rights to Use Water in the Gila River Sys. & Source, No. W-1, W-2, W-3, W-4 (Consolidated), Contested Case No. W1-103 (Ariz. Super. Ct. Maricopa Cnty. filed Aug. 16, 2010), *available at* http:// www.superiorcourt.maricopa.gov/SuperiorCourt/Adjudications/_ballinger/W1-103***o***rd082410.pdf.

[264] *See* Marder, *supra* note 256, at 192-96 (2009) (discussing the battle between the Salt River Project and City of Prescott and the Town of Prescott Valley over the Big Chino Aquifer); *Prescott and Prescott Valley Enter Agreement with SRP over Big Chino Water Management Issues*, SRP NET, http:// www.srpnet.com/water/agreement.aspx (last visited Apr. 4, 2011) (an agreement was made in February 2010 resolving the conflict out of court).

[265] 1980 Ariz. Sess. Laws, 176 (codified as amended at ARIZ. REV. STAT. §§ 45-401-704); Davis v. Agua Sierra Resources, L.L.C., 203 P.3d 506, 509 (Ariz. 2009); Strawberry Water Co. v. Paulsen, 207 P.3d 654, 661 n.7 (Ariz. App. 2008).

[266] Avery et. al., *supra* note 26, at 341.

[267] *Id.*

[268] Interview with Kathy Farris, Director, Groundwater Management Study Commission (4th), CENT. ARIZ. PROJECT, 7-8, http:// www.capaz.com/includes/docs/oral/Interview%20with%CC20Kathy%20Ferris.pdf (the fourth Groundwater Management Study Commission was responsible for overhauling Arizona's groundwater code); Avery et. al., *supra* note 26, at 341; Zachary A. Smith, *Federal Intervention in the Management of Groundwater Resources: Past Efforts and Future Prospects*, 15 PUBLIUS 145, 150 (1985).

[269] Farmers Inv. Co. v. Bettwy, 558 P.2d 14, 24 (Ariz. 1976); Avery et. al., *supra* note 26, at 341.

[270] *Id.*

[271] ARIZ. REV. STAT. § 45-401(B) (2010).

[272] *Id.*

[273] Davis v. Agua Sierra Resources, L.L.C., 203 P.3d 506, 509 (Ariz. 2009) (citing ARIZ. REV. STAT. §§ 45-411-451(A)(1)).

[274] ARIZ. REV. STAT. § 45-462 (2010).

[275] Within AMAs, type 1 grandfathered rights and type 2 grandfathered rights are transferable. Type 1 water rights are appurtenant to the land and are only transferable when title to the land is bought. ARIZ. REV. STAT. §§ 45-461(3)(a),463(E),465(D). Type 2 water rights are not tied to the land's title and can be sold or leased without buying the land. ARIZ. REV. STAT. §§ 45-461(3)(a), 463(E), 465(D).

[276] *See*ARIZ. REV. STAT. §§ 45-451-455 (2010).

[277] Avery et. al., *supra* note 26, at 341.

[278] Strawberry Water Co. v. Paulsen, 207 P.3d 654, 661 n.7 (Ariz. App. 2008).

[279] ARIZ. REV. STAT. § 45-453(1).

[280] Strawberry Water, 207 P.3d 654, 661 n.7 (Ariz. App. 2008) (citing Ariz. Rev. Stat. §§ 45-401-704).

[281] Avery et. al., supra note 26, at 341-42.

[282] ARIZ. REV. STAT. § 45-411 (2010).

[283] ARIZ. REV. STAT. § 45-431 (2010).

[284] Davis v. Agua Sierra Resources, L.L.C., 203 P.3d 506, 509 (Ariz. 2009) (citing ARIZ. REV. STAT. § 45-453).

[285] *Davis*, 203 P.3d at 509 (citing Chino Valley v. Prescott (*Chino Valley II*), 638 P.2d 1324, 1325 n.* (Ariz. 1981)).

[286] ARIZ. REV. STAT. § 45-411(A)(1)-(4).

[287] 1994 Ariz. Sess. Laws, ch. 296, § 5 (codified at ARIZ. REV. STAT. ANN. § 45-411.03 (2011)). *See generally Santa Cruz AMA*, ARIZ. DEP'T OF WATER RES., http:// www.azwater.gov/azdwr/WaterManagement/AMAs/SantaCruzAMA/default.htm (last visited Mar. 20, 2011).

[288] *AMAs*, ARIZ. DEP'T OF WATER RES., http:// www.azwater.gov/AzDWR/WaterManagement/AMAs/default.htm (last visited Mar. 20, 2011).

[289] ARIZ. REV. STAT. § 45-562(C) (2010).

[290] ARIZ. REV. STAT. § 45-562(B).

[291] *See*ARIZ. REV. STAT. §§ 45-431-432

[292] *AMAs*, *supra* note 288.

[293] ARIZ. REV. STAT. § 45-432(A).

[294] ARIZ. REV. STAT. §§ 45-434-437. For instance, in the Joseph City and Douglas INAs, only land that was legally irrigated during the period of January 1, 1975 to January 1, 1980 can be irrigated with groundwater, effluent, diffused water or surface water. ARIZ. REV. STAT. ANN. § 45-437(A). For land designated as an INA in the future, only land that was irrigated during the preceding five years can be irrigated. ARIZ. REV. STAT. § 45-427(B).

[295] ARIZ. REV. STAT. § 45-454(A).

[296] ARIZ. REV. STAT. § 45-454(B).

[297] Rita Pearson Maguire, *Patching the Holes in the Bucket: Safe Yield and the Future of Water Management in Arizona*, 49 ARIZ. L. REV. 361, 379-80 (2007).

[298] NATHAN BRACKEN, W. STATES COUNCIL, EXEMPT WELL ISSUES IN THE WEST 146-47 (2010), *available at* http://aquadoc.typepad.com/files/exempt_wells_in_ the_west_n_bracken.pdf; EXEMPT WELLS SUBCOMM., STATEWIDE WATER ADVISORY GRP., DRAFT PROPOSAL: WATER INFORMATION FOR WELL OWNERS (Mar. 5, 2007), *available at* http://www.adwr.state.az.us/AzDWR/StatewidePlanning/SWAG/documents/Proposal_ Well_Information.pdf; Cally Carswell, *Death by a Thousand Wells*, HIGH COUNTRY NEWS, Oct. 26, 2009, http://www.hcn.org/issues/41.18/death-by-athousandwells.

[299] Maguire, *supra* note 297, at 380.

[300] ARIZ. REV. STAT. ANN. § 45-576; *See* Robert Jerome Glennon, *Coattails of the Past: Using and Financing the Central Arizona Project*, 27 ARIZ. ST. L.J. 677, 696 (1995).

[301] *See*ARIZ. REV. STAT. § 32-2101(56) (definition of subdivision).

[302] ARIZ. REV. STAT. ANN. § 45-576(A); ARIZ. ADMIN. CODE. § 12-15-704 (2010).

[303] ARIZ. REV. STAT. ANN. § 45-576(J); ARIZ. ADMIN. CODE. § 15-703-707 (2010).

[304] ARIZ. REV. STAT. ANN. § 45-576(A). A designation means that the company has a water supply sufficient to serve their current committed and future demand for 100 years as well as the other AWS criterion. Water companies do not have to apply for a designation. ARIZ. ADMIN. CODE. § 12-15-710 (2010); ARIZ. DEP'T OF WATER RES., ASSURED WATER SUPPLY PROGRAM 3 (Nov. 1, 2001), *available at* http:// www.azwater.gov/AzDWR/WaterManagement/AAWS/documents/awsbrochuredescription000.pdf.

[305] *See* Megdal, *supra* note 28, at 3-4.

[306] ARIZ. ADMIN. CODE. § 12-15-716 (2010).

[307] ARIZ. ADMIN. CODE. § 15-701(27) (2010).

[308] ARIZ. ADMIN. CODE. § 12-15-716(B) (2010).

[309] *Id.*

[310] ARIZ. ADMIN. CODE. § 12-15-716; Maguire, *supra* note 297, at 364.

[311] Glennon, *supra* note 247.

[312] *Id.*

[313] K.E. Randall, *The Arizona Riparian Area Advisory Committee: An Experience in Defining Desired Conditions*,U.S. FOREST SERVICE: ROCKY MOUNTAIN RESEARCH STATION (1996), *available at* http://www.fs.fed.us/rm/pubs_rm/rm_ gtr272/rm_gtr272_216_226.pdf.

[314] *Id.*

315 *Id.*

316 ARIZ. REV. STAT. § 45-101; Randall, *supra* note 313, at 260.

317 *See generally* Randall, *supra* note 313.

318 *Id.*

319 *Id.*

320 *Id.*

321 Ariz. Exec. Order No. 2000-7 (2000).

322 GOVERNOR'S WATER MANAGEMENT COMM'N, FINAL REPORT V (2001).

323 *Id.* at 9.

324 ARIZ. REV. STAT. § 45-2101(B) (2010).

325 Telephone Interview with John Keane, Commission Member, Arizona Water Protection Fund, in Phoenix, Ariz. (July 2, 2010) (on file with author).

326 Central Arizona Project, Arizona: Water Allocations and Water Service Contracting; Record of Decision, 48 Fed. Reg. 12446 (Mar. 24, 1983). *See* Letter from Wesley E. Steiner, Director of ADWR to CAP Applicants, CAP Historical Documents (March 1, 1983), http:// www.capaz.com/includes/media/docs/CAP-allocation-ROD--3-1983.pdf (last visited Oct. 15, 2010). These CAP allocations were based on the State of Arizona's 1982 allocation recommendations for non-Indian entities. *See* Letter from Wesley E. Steiner, Director of ADWR, to James Watt, U.S. Secretary of the Interior, Central Arizona Project (Jan. 18, 1982), http:// www.capaz.com/includes/media/docs/ADWR-allocation-decision-1-18-1982.pdf (last visited Oct. 15, 2010).

327 Maguire Telephone Interview, *supra* note 325.

328 Payson was allocated 4995 acre-feet annually. Central Arizona Project, Arizona, *supra* note 326; *Central Highlands Planning Area Water Supply-Central Arizona Project Water*, ARIZ. DEP'T OF WATER RES., http:// www.azwater.gov/azdwr/StatewidePlanning/WaterAtlas/CentralHighlands/PlanningAreaOverview/ WaterSupply.htm (last visited Oct. 15, 2010) [hereinafter *Central Highlands Planning Area*].

329 Maguire Telephone Interview, *supra* note 325. Unused CAP allocations were viewed as an asset that could be exchanged by the recipient in the future. *Id.* In order to make use of their CAP allocation, it was anticipated that these communities, mining companies, and private water companies outside of the CAP service area would exchange their CAP entitlement for a locally available surface water supply often held by a downstream senior water right appropriator located within the CAP service area. *Id.*

330 *Central Highlands Planning Area*, *supra* note 328 (the gross proceeds from this sale were $4,995,000. This value does not reflect the reduction associated with equivalency charges and capital costs due to CAWCD or other fees associated with the entitlement transfer actions. The U.S. Bureau of Reclamation manages a trust fund with the money acquired in the transfer; the trust fund is

used to develop alternative water supplies for Payson).

331 Maguire Telephone Interview, *supra* note 325.

332 *Id.*

333 JOHN L. KEANE, RIPARIAN IMPROVEMENTS: KEY ISSUES EMERGING FROM A STATE GRANTS PROGRAM 2 (2000); Maguire Telephone Interview, *supra* note 325.

334 KEANE, *supra* note 333.

335 Maguire Telephone Interview, *supra* note 325.

336 *Id.*

337 KEANE, *supra* note 333.

338 ARIZ. REV. STAT. § 45-2101 (2010).

339 ARIZ. REV. STAT. § 45-2103 (2010).

340 KEANE, *supra* note 333. *See*ARIZ. REV. STAT. § 45-2101.

341 KEANE, *supra* note 333.

342 On the other hand, there are some benefits to a decentralized approach. Personal Communication with John Keane (Nov. 4, 2010) (on file with author). The state can deal with local landowners, agencies and communities that are willing participants and who are most knowledgeable about the local riparian conditions. *Id.* A bottom-up approach can bring out creative restoration techniques and approaches. *Id.*

343 *Id.*

344 *Id.*

345 *Funded Projects*, ARIZ. WATER PROTECTION FUND, http:// www.azwpf.gov/Grant_Project_Reports/default.htm (providing a list of funded projects throughout Arizona) (last visited Mar. 20, 2011).

346 *Winters*, *supra* note 52.

347 Nevada v. U.S., 463 U.S. 110, 117 (1983); Cappaert v. U.S., 426 U.S. 128, 138 (1976) (citing the long established rule that the reservation of water rights is a constitutional right empowered by the Commerce Clause, which permits federal regulation of navigable streams, and the Property Clause, which permits federal regulation of lands); Winters v. U.S., 207 U.S. 564, 212 (1908).

348 *Id.*

[349] 16 U.S.C. § 15320 (5)(a)(i) (2010).

[350] *Supra* note 79.

[351] *See supra* notes 91-92.

[352] City of Los Angeles v. Venice Peninsula Props., 644 P.2d 792, 793-94 (Cal. 1982)

[353] Craig, *supra* note 108, at 84-85.

[354] *Id.* at 83.

[355] *Id.* at 86.

[356] *Id.*

[357] *In re Water Use Permit Applications*, 9 P.3d 409, 448 (Haw. 2000); Craig, *supra* note 108, at 86.

[358] *See supra* Part V(B)(ii)i.

[359] SAX ET AL., *supra* note 100, at 189.

[360] *Id.*

[361] CAL. WATER CODE § 1011(a) (2000).

[362] *Id.*

[363] ALASKA STAT. § 46.15.145(a) (2009); State v. Morros, 766 P.2d 263 (Nev. 1988).

[364] ARIZ. REV. STAT. § 45-172 (2010).

[365] WASH. REV. CODE § 90.03.005 (2010).

[366] WASH. REV. CODE § 90.22.010.

[367] WASH. REV. CODE § 90.22.060.

[368] ARIZONA GOVERNOR'S WATER MANAGEMENT COMMISSION'S FINAL REPORT, vii, 26, 37 (2001).

[369] *Id.* at 37.

[370] *Id.* at vii, 26.

[371] *Id.* at 27.

[372] *Id.* at viii, 27.

[373] ARIZONA GOVERNOR'S WATER MANAGEMENT COMMISSION'S FINAL REPORT, viii, 27 (2001).

[374] *Id.*

[375] Marie Light, *Annual Report of the Arizona Water Protection Fund Commission* 5-9 (2009), *available at* http://www.azwpf.gov/Pubs/FY2009/FY%202009%CC20Annual%C[illegible]eport.pdf. For example, the AWPF has funded 199 projects and contributed nearly $41 million towards riparian zone restoration, protection, and enhancement. *Id.* at 2.

[376] *See* Sharon B. Megdal, Joanna Bate & Andrew Schwarz, *Securing Water for Environmental Purposes: Establishing Pilot Programs* 5 INT'L J. ENVTL. CULTURE & SOC. SUSTAINABILITY 2009), *available at* http:// ag.arizona.edu/azwater/files/SecuringWaterfortheEnvironment_IJS-final.pdf; Andrew Schwarz & Sharon B. Megdal, *Conserve to Enhance: Voluntary Municipal Water Conservation to Support Environmental Restoration,* 100 AM. WATER WORKS ASS'N 42 (2008).

[377] *See supra* Part II (assessing Arizona's environmental water needs).