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Forgetting Nature: The Importance of Including Environmental Flows in International Water Agreements

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INTRODUCTION

From the moment States created political boundaries to define their territory, they have shared water.¹ There are 263 transboundary lake and river basins worldwide and 300 known transboundary aquifer systems.² Whenever sharing is present, the opportunity for conflict is too.³ Climate change and increasing population are only two factors that may lead to increasing conflict if attention is not given to these situations.⁴ Thankfully, sharing water also creates an opportunity for cooperation. Throughout the world, there are increasing examples of conflict and cooperation regarding shared water resources.⁵

International water agreements can promote regional peace and security and encourage economic growth. By asking States to cooperate, they must account for their current and future uses within the natural system, which can lead to the best use of the water.⁶ An agreement can ensure continued cooperation in low water years or support data collection and sharing because a transboundary relationship already exists.⁷

Without an agreement, decisions can become reactive and lead to inefficiencies. Increasing demand on water from all sectors increases accountability between users. When there is not enough for everyone, those who receive the water must be able to defend their use as worthy. Unfortunately, these decisions are often based on politics and influence

¹ UN WATER, TRANSBOUNDARY WATER: SHARED BENEFITS, SHARING RESPONSIBILITIES 1 (2008).

² *Id.* While there are many agreements for surface water, there is remarkably little joint management of groundwater despite its growing importance.

³ *Id.* at 2.

⁴ *Id.*

⁵ *Compare* Pacific Institute, Water Conflict Chronology List, <http://www2.worldwater.org/conflict/list/> (last visited Apr. 22, 2016) (chronicling the history of water conflicts), *with* INT'L BOUNDARY & WATER COMM'N, MINUTE 319, INTERIM INTERNATIONAL COOPERATIVE MEASURES IN THE COLORADO RIVER BASIN THROUGH 2017 AND EXTENSION OF MINUTE 318 COOPERATIVE MEASURES TO ADDRESS THE CONTINUED EFFECTS OF THE APRIL 2010 EARTHQUAKE IN THE MEXICALI VALLEY, BAJA CALIFORNIA (2012), http://www.ibwc.state.gov/Files/Minutes/Minute_319.pdf (providing an example of international water cooperation).

⁶ *See, e.g.*, Mekong River Commission, Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin (Apr. 5, 1995), <http://www.mrcmekong.org/assets/Publications/policies/agreement-Apr95.pdf> (including provisions for low water and high water).

⁷ *See, e.g., id.*; G.A. Res. 51/229, United Nations, Convention on the Law of the Non-Navigational Uses of International Watercourses, (1997), http://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf [hereinafter International Watercourses Convention].

and not on selecting the highest valued use. Water is often numerically divided and the focus shifts to delivery mechanisms to meet human needs while those users with no voice are forgotten.

There is no better example of a forgotten voice than the environment.⁸ Often, with no one to advocate for the environmental flow allocations, nature's uses are entirely left out of international water negotiations and subsequent agreements. Neglecting environmental considerations and impacts is not only bad for the environment, but it can also be harmful to the sustainability of the participating States. Economic success and social sustainability is intricately tied to the natural environment.⁹ Failure to consider the ecosystem and watershed dynamics can undermine any shared use agreement as well as the community the agreement is meant to assist.¹⁰

The incorporation of environmental terms into international agreements is not unprecedented.¹¹ Although only a few agreements explicitly dedicate a quantity of shared water to nature, many others have terms that indirectly involve ecological water needs.¹² Some of these international treaties are not specific to water, but their subject is water dependent such as wetlands or endangered species habitats.¹³ Other agreements speak generally to the interdependence between humans and the environment. These documents advocate for the protection of the latter to ensure the continued success of the former. Each of these existing treaties can assist future drafters in ways that create holistic documents.

A recent project along the United States/Mexico border seeks to create a different paradigm.¹⁴ While water sharing of the Colorado River historically followed the traditional protocol of focusing on people and delivery quantities, a new agreement adds the environment to the equation.¹⁵ Before the Colorado River was divided among the

⁸ See, e.g., Wade Davis, *Wade Davis on Loss in the Colorado River Delta*, NAT'L GEOGRAPHIC (Jan. 3, 2013), <http://voices.nationalgeographic.com/2013/01/03/wade-davis-on-loss-in-the-colorado-river-delta/>.

⁹ Adreman et al., *The Changing Role of Ecohydrological Science in Guiding Environmental Flows*, 59 (3-4) *Hydrological Sciences Journal—Journal des Sciences Hydrologiques* 433, 440 (2014).

¹⁰ *Id.*

¹¹ See discussion *infra* Part IV.

¹² See, e.g., International Watercourses Convention, *supra* note 7.

¹³ See discussion *infra* Part IV.C.

¹⁴ See discussion *infra* Part V.

¹⁵ Davis, *supra* note 8.

U.S. states, it created one of the most important desert estuaries in the world as it made its way into the Gulf of California. The Colorado River Compact and the incredible engineering that followed destroyed most of the ecosystem that was the Colorado River Delta. Signed in 2012, Minute 319 created a pilot project to return water to the Delta and update the 1944 Treaty with additional flexibility to assist in water conservation and best practices.¹⁶ This new agreement provides a model for updating other agreements to include our expanded understanding of our dependence on the natural world.

This paper advocates for the inclusion of environmental flow provisions in international water sharing agreements. When nature's water needs are not considered at the time of negotiation, the agreement and the signatories' sustainability are placed in peril. Part I briefly tracks the history of international water agreements and describes how flows for the environment have taken a backseat to water delivery obligations for human needs.¹⁷ Part II explains the basic science of environmental flows and explores the benefits ecosystem services can provide for the participating States.¹⁸ Part III examines international and domestic laws that provide both precedent and guidance for how water should be expressly set aside for nature.¹⁹ Part IV looks at the history of the Colorado River at the U.S.-Mexico border as a case study,²⁰ describing how the recent agreement Minute 319 gave the environment a second chance after being forgotten for half a century.

Finally, Part V proposes some parameters to include in an international water negotiation to better include environmental factors. First, the shared water body must be evaluated as part of the larger drainage basin to include other hydrologically related waters if they are present.²¹ If the international water is understood in a larger context, unintended consequence can be avoided. Second, water needs to be set aside for environmental needs.²² Doing this recognizes the interdependence of natural ecology with the participating communities and protects it. Finally, wherever possible, public participation and partnering with nonprofit organizations should be maximized.

¹⁶ INT'L BOUNDARY & WATER COMM'N, *supra* note 5.

¹⁷ *See* discussion *infra* Part I.

¹⁸ *See* discussion *infra* Part II.

¹⁹ *See* discussion *infra* Part III.

²⁰ *See* discussion *infra* Part IV.

²¹ *See* discussion *infra* Part VI.A.

²² *See* discussion *infra* Part VI.B.

Increasing stakeholder buy-in and expertise up front will ensure more needs are met, which assists in implementation.²³

I

SHARING WATER THE OLD FASHIONED WAY: DELIVERY BY THE NUMBERS

Most of the world's inhabitants live in countries that share water across an international border, and forty percent of the world's population live in a shared surface water basin.²⁴ While available to citizens of different countries, these shared resources link the people of these nations in special and unique ways. "All transboundary water bodies create hydrological social and economic interdependencies between societies."²⁵ While living in two sovereign lands that may have distinct culture and economies, their shared dependence on a water source bridges political and cultural gaps. As such, considerations must be made about how to share the water equitably.

Historically, if water apportionment is sought through a treaty or international agreement, States often negotiate allocation based on current water needs and economies in their state, while other needs are forgotten.²⁶ Although water is essential for economic development and success, people are not the only ones who use water.²⁷ Often overlooked in State negotiations are water systems that support land and water ecosystems, which are critical for a functioning economy.²⁸ "The importance of a river's flow regime for sustaining biodiversity and ecological integrity is well established."²⁹ For example, wetlands, often fed by diverse water sources, provide food and other economic necessities, including water quality benefits.³⁰ Similarly, fresh water

²³ See discussion *infra* Part VI.C.

²⁴ UN WATER, *supra* note 1.

²⁵ *Id.*

²⁶ International Watercourses Convention, *supra* note 7 (listing factors to be considered for equitable and reasonable apportionment in an international water agreement, which focus primarily on the States' population, current water uses and available alternate sources).

²⁷ *Id.*

²⁸ *Id.*; Adreman et al., *supra* note 9, at 434.

²⁹ N. Leroy Poff & Julie K Zimmerman, *Ecological Responses to Altered Flow Regimes: A Literature Review to Inform the Science and Management of Environmental Flows*, 55 FRESHWATER BIOLOGY 194, 195 (2009).

³⁰ UN WATER, *supra* note 1.

inflows to bays and estuaries can be critical to maintaining recreational and commercial fishing economies.³¹

While two sovereigns sharing a resource as important as water creates an opportunity for conflict, the situation also creates an opportunity for cooperation.³² In fact, attempting to avert conflict can be a powerful driver for cooperation. The goal is for cooperative agreements to not only consider the people using the water, but the sustainability of the water resource and associated ecosystems as well. States that work together are more likely to be successful at managing complex ecological systems while still benefitting from water allocations.³³

Cooperation for shared water is not a new concept. Historically, these agreements varied both in scope and success. While there is no single, correct way to create an international water agreement, some general principles should be followed.³⁴ Any arrangement must be tailored to the specific characteristics and needs of the basin as well as its citizens.³⁵ The goals created for an agreement must be considered in relation to the capacity of the natural environment and not in a vacuum. Unfortunately, there are many examples where this has not occurred.

As noted, the purpose of many international water agreements is to divide shared water for use by each State's citizens. Division agreements can be written in general terms³⁶ or they can take the form of specific quantities. When the latter happens, delivery is the key to compliance; therefore, engineering discussions are quick to follow. The receiving country wants to ensure it receives its share, and the promising country wants to fulfill its legal obligations. Solutions for delivery related issues (such as lining delivery channels with cement, installing pipelines, and other construction-oriented solutions) often have unintended consequences for other users and the environment.

³¹ See National Research Council of the National Academies, *The Science of Instream Flows: A Review of the Texas Instream Flow Program* 1–3, https://tpwd.texas.gov/publications/nonpwdpubs/media/nas_report.pdf (last visited Apr. 22, 2016).

³² There is a long history of water conflicts. See Pacific Institute, *supra* note 5. Sources of conflicts include scarcity, access, dam construction, water quality and lack of an agreement. UN WATER, *supra* note 1, at 2.

³³ UN WATER, *supra* note 1, at 3.

³⁴ See International Watercourses Convention, *supra* note 7.

³⁵ See UN WATER, *supra* note 1, at 3, 6.

³⁶ More general terms can include a percentage of water or “fair share” language that maximizes flexibility.

Proponents of canal lining contend that concrete will aid in greater efficiency of water deliveries and reduction of waste in transport via seepage.³⁷ Farmers who will benefit from the lining are generally delighted to see a project completed,³⁸ but this excitement often comes at the detriment of other users along the watercourse.³⁹ For example, Mexican officials estimate that lining of Canal Revolución, which delivers Colorado River water from Arizona to Mexico, will “save” roughly 16,000 acre-feet in water “losses” annually.⁴⁰ However, farmers who rely on groundwater wells that pump this “lost” water are facing the same challenges that have historically arisen with similar lining projects—arrogation of their water source.⁴¹ While concrete lining may increase reliability of water delivery to destination areas, the historical disadvantages of concrete lining must also be addressed. In most basins, there is no “extra” water, so lining forces a reallocation rather than pure savings. In addition, canalization can take critical water away from non-human actors.

II THE POWER OF FLOWS

While releases of stored water for downstream users is not a new concept, releasing water primarily for environmental purposes is a more modern construct.⁴² “Environmental flows can be described as ‘the quality, quantity, and timing of water flows required to maintain the components, functions, processes, and resilience of aquatic ecosystems which provide goods and services to people.’”⁴³ These flows are often divided into two categories. The first is instream flows, which

³⁷ Regina M. Buono & Gabriel Eckstein, *Minute 319: A Creative Approach to Modifying Mexico-U.S. Hydro Relations Over the Colorado River*, 39 WATER INTERNATIONAL 8 (2014); Sandra Dibble & Bradley J. Fikes, *Mexican Canal Lining Brings Cross-Border Dividends*, SAN DIEGO UNION-TRIBUNE (July 4, 2015), <http://www.sandiegouniontribune.com/news/2015/jul/04/mexican-canal-lining-water-minute-319/>.

³⁸ See Dibble & Fikes, *supra* note 37 (quoting a Mexican farmer who will benefit from the lining, exclaiming that “[i]t’s a great project that we’ve been waiting for years to happen . . . [i]t’s a benefit for everyone, for us and for California”).

³⁹ See *id.* (pointing out that Mexican farmers who irrigated from seepage from the AAC subsequently lost out after that project was completed, as well as after the construction of the Warren H. Brock Reservoir).

⁴⁰ *Id.*

⁴¹ *Id.*

⁴² Adreman et al., *supra* note 9, at 436.

⁴³ World Bank Group, Water, <http://water.worldbank.org/topics/environmental-services/environmental-flows> (last visited Apr. 22, 2016).

is water flowing along the river reach being utilized by the surrounding ecosystem.⁴⁴ The second is freshwater inflows, which is the water necessary to maintain healthy bay and estuary systems at the river's confluence.⁴⁵

“The term ‘environmental flows’ is now widely used to reflect the hydrological regime required to sustain freshwater and estuarine ecosystems, and the human livelihoods and well-being that depend on them.”⁴⁶ Well-designed flow programs allow for a minimum flow requirement below which the river is not to fall. Even more importantly, well-designed flow regimes also consider the range of conditions required for a healthy river including subsidence flows, base flows, and pulse flows.⁴⁷ The specifics of an ideal flow regime vary based on local factors such as climate, geography, hydrogeology and human alterations such as impervious cover, dams and diversions.⁴⁸

The importance of having all stages of a healthy river (including flood events) cannot be overstated.⁴⁹ For example, a pulse flow is a period of high flow meant to mimic a natural flood event.⁵⁰ In many rivers, natural pulse flows occurred annually during spring snowmelt. Now, these floods are prevented on many rivers by over-allocation of water or over-management using dams and reservoirs. This prevents high-energy water from scouring the riverbed and depositing fertile soil outside the riverbanks.⁵¹ These floods also provided much needed water to hydrologically related plant-rich areas, such as wetlands.⁵²

⁴⁴ Texas Living Waters Project, What Are Environmental Flows?, <http://texaslivingwaters.org/environmental-flows/eflows/> (last visited Apr. 22, 2016).

⁴⁵ *Id.*

⁴⁶ Adreman et al., *supra* note 9.

⁴⁷ *Id.* at 433, 437, 439. “Ecosystems are dynamic, so the adoption of environmental flows needs to have a similar dynamic basis.” *Id.* Determining the goals for each flow level requires a multidisciplinary approach including factors such as geomorphology, biology, and water quality. *Id.* at 439.

⁴⁸ N. Leroy Poff & Julie K Zimmerman, *Ecological Responses to Altered Flow Regimes: A Literature Review to Inform the Science and Management of Environmental Flows*, 55 FRESHWATER BIOLOGY 194, 195 (2009).

⁴⁹ Latha Anantha & Parineeta Dandekar, *Towards Restoring Flows into the Earth's Arteries: A Primer On Environmental Flows* 20 (2012), http://www.internationalrivers.org/files/attached-files/eflows_primer_062012.pdf (last visited Apr. 22, 2016) (listing benefits at all levels of river flow); Adreman et al., *supra* note 9, at 440. “Ecological processes maintain the planet's capacity to deliver goods and services, such as water, food and medicines and much of what we call ‘quality of life’” *Id.* at 436.

⁵⁰ Texas Living Waters Project, *supra* note 44.

⁵¹ Flood flows have been found to affect bank vegetation. Adreman et al., *supra* note 9, at 440.

⁵² *See id.* at 437–38.

Ecological health is directly related to social and economic health. “Environmental flows can help improve water quality, such as diluting effluent and maintaining oxygen levels and water temperature, and can address quantity issues.”⁵³ Ecosystem services are the benefits humans gain from a healthy environment. “[H]ealthy freshwater ecosystems provide economic security” by providing fish, medicines and timber; protecting against natural hazards; and protecting human and other species’ rights to water.⁵⁴ Protecting ecologically sensitive areas such as wetlands can reduce water treatment needs and minimize adverse flooding impacts.⁵⁵ Including environmental protections in a shared water agreement will also protect the citizens of signatory States. While environmental flows are not often seen in international water agreements, precedent does exist for their consideration.

III

PRECEDENT FOR INCLUDING FLOWS IN INTERNATIONAL WATER AGREEMENTS

Despite the benefit for all parties, most international agreements and domestic law contemplate the environment only as a passing consideration.⁵⁶ Few, if any, agreements focus on environmental flows and ecosystem preservation as a primary goal. Some lessons can still be learned from each as international and domestic water management regimes seek to brave new ground and move beyond solely water delivery for human needs.

A. The Environment in International Water Agreements

When reviewing the landscape of international water agreements, an appropriate starting place is the Convention on the Law of the Non-navigational Uses of International Watercourses (Watercourse Convention). This treaty, completed in 1997 and entered into force on

⁵³ *Id.* at 440.

⁵⁴ *Id.* at 436.

⁵⁵ A tragic example of negative impacts associated with the eradication of wetlands was the flooding of New Orleans and the surrounding parishes during Hurricane Katrina. John Tibbetts, *Louisiana’s Wetlands: A Lesson in Nature Appreciation*, 114 ENVIRON HEALTH PERSPECT. A 40, (2006), <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1332684/pdf/ehp0114-a00040.pdf>. Under natural conditions, the wetlands functioned as buffer between the sea and civilization; however, over-engineering of the river destroyed thousand of miles of wetlands leaving the cities exposed to the storm surge. *Id.* at A 40–42.

⁵⁶ See Adreman et al., *supra* note 9, at 434.

August 15, 2015, constitutes customary international law in the context of shared water. As stated above, many aspects of this document focus on human needs, but the environment was not forgotten.

The first indirect environmental consideration in the Watercourse Convention is its application to the entire watercourse. The watercourse is defined as “a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus.”⁵⁷ This is important because, although not directly stating the word environment, the recognition of flow relationships requires its consideration. The understanding that water is a system, composed of related ecosystems, inherently encompasses the idea that wetlands or springs are included in that system.

In addition to the Treaty’s inclusive definition of watercourse, environmental considerations are present in other provisions. One of the keystones of the Watercourse Convention is the obligation for States to divide their water in an equitable and reasonable manner. While there is no bright line test for this, a series of criteria are identified to determine how to reach such a division. Importantly, ecosystems are included among the factors listed involving water resources and how citizens use water. The list of factors includes, “[g]eographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character.”⁵⁸ Although nothing requires that ecosystems be considered in the division of water, such consideration is specifically enumerated as a suggested factor to be considered.

While any recognition of the relationship between water and the environment is noteworthy, neither of the above-discussed terms of the Watercourse Convention provides any explicit environmental obligations. However, Part IV of the Convention, entitled “Protection, Preservation and Management,” takes a different approach by imposing several express environmental obligations.⁵⁹ The first obligation is most germane to this discussion. Article 21 states, “Watercourse States shall, individually and, where appropriate, jointly, protect and preserve the ecosystems of international watercourses.”⁶⁰ While not dictating how the States should achieve this goal, the requirement clearly includes maintaining environmental flow regimes

⁵⁷ International Watercourses Convention, *supra* note 7, at art. 2.

⁵⁸ *Id.*

⁵⁹ *Id.*

⁶⁰ *Id.* at art. 21.

for the benefit of surrounding flora and fauna. Article 23 goes a step further by requiring the protection and preservation of the marine environment including estuaries.⁶¹ Unfortunately, there is no similar article imposing a non-marine water obligation; however, the inclusion of these terms in international agreements would expand the scope of environmental considerations when water is divided.

Unlike most international water treaties that do not include an environmental component, the April 1995 Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin is a remarkable exception.⁶² This accord, signed by four nations, lists both sustainable development and conservation among its primary goals. It goes on to recognize the economic value provided by the environment and the Mekong River Basin.⁶³ Much like the ethic recognized in the Rio Convention discussed below, the preamble of the Mekong Agreement links the social and economic success of the signatory States to the protection of the river's ecosystem rather than seeing these goals as separate.⁶⁴ To accomplish these goals, the specific agreement terms are constructed in a way that balances the ecological non-navigational needs of the river with the economic and navigational needs of the State.⁶⁵

Beyond discussing the environment and ecology as a general amorphous goal, the Mekong Agreement defines and sets flow condition requirements. The requirements take the natural climate into consideration by setting a "minimum monthly flow" that is allowable through the dry season and an "acceptable natural reverse flow"⁶⁶ that is allowable during the rainy season. During the latter, "the Mekong River at Kratie . . . allows the reverse flow of the Tonle Sap to an agreed upon optimum level of the Great Lake."⁶⁷

The Mekong Agreement has several noteworthy aspects that model what future agreements can achieve. First, the flow discussion is tailored to local characteristics, such as climate and flow variations,

⁶¹ *Id.* at art. 23.

⁶² Mekong River Commission, *supra* note 6.

⁶³ *Id.* at 1. "Recognizing that the Mekong River Basin and the related natural resources and environment are natural assets of immense value to all the riparian countries for the economic and social well-being and living standards of their peoples."

⁶⁴ *See id.*

⁶⁵ *See id.* at 3.

⁶⁶ *Id.* at 2-3.

⁶⁷ *Id.*

while still honoring local needs in relation to the river and respecting local sovereignty.⁶⁸ The Agreement also approaches the Mekong as a river system by including flow levels of major tributaries.⁶⁹ Another important aspect is the recognition and protection of navigational uses as well as non-navigational uses. While this may not be necessary for all treaties, it reflects this community's multifaceted economic dependency on this river. Finally, the agreement makes allowances for extenuating circumstances by alleviating flow obligations during times of extreme drought. While the Mekong Agreement may be one of the few international treaties to include a flow regime, it is not the only example of international recognition of peoples' economic dependence on the natural world.

B. International Environmental Treaties

In addition to international water law, other international law documents support and encourage integration of the environment into development decisions. The first of these is the 1992 United Nations Conference on Environment and Development in Rio de Janeiro.⁷⁰ Often referred to as the Earth Summit, this Conference had participants from 170 nations and 2,400 NGOs. In the conference Declaration, the signing States recognize that any one State's right to exploit resources within its boundaries is limited by its obligation to not damage the environment of other States.⁷¹ In addition to creating a legal obligation between States, the conference mandates that protection of the environment must be for the use and enjoyment of present as well as future generations.⁷² To achieve these goals, the environment must be integrated into all development decisions.

The 1992 Rio De Janeiro conference marks a shift in understanding the relationship between the environment and people.⁷³ The conference demonstrated the interdependence between environmental protection

⁶⁸ *Id.* at 3–4.

⁶⁹ *Id.* at 1–2.

⁷⁰ U.N. Conference on Environment and Development, Rio Declaration on Environment and Development, U.N. Doc. A/CONF.151/26 (Vol. I) (Aug. 12, 1992), <http://www.unep.org/documents.multilingual/default.asp?documentid=78&articleid=1163> [hereinafter Rio Declaration]. “Human beings . . . are entitled to a healthy and productive life in harmony with nature.” *Id.*

⁷¹ *Id.*

⁷² *Id.*

⁷³ Adreman et al., *supra* note 9, at 436.

and a prosperous future for humanity.⁷⁴ Sufficient water quality and quantity is a key component of this relationship.

In addition to the conference Declaration, another important agreement was reached in Rio. The Convention on Biological Diversity (CBD), known informally as the Biodiversity Convention, is a multilateral treaty signed by 168 countries and entered into force on December 29, 1993. The Convention has three main goals: (1) conservation of biological diversity (or biodiversity); (2) sustainable use of its components; and (3) fair and equitable sharing of benefits arising from genetic resources.⁷⁵ Like the Rio Declaration, the CBD limits sovereignty by prohibiting actions by one State that cause environmental damage in another State. Article Six requires signatories to “[d]evelop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies” and “[i]ntegrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.”⁷⁶ The CBD then elucidates the technical and political ways these obligations can be achieved.

Freshwater ecosystems provide significant services necessary for human wellbeing. Therefore, equitable and sustainable water management is crucial to achieving the goal of ecological protection and maintenance mandated by the CBD. While water management is not explicitly listed in the original CBD, its importance has received increased recognition in follow-on documents. Annex VII/4, drafted in 2004 and entitled Biological Diversity of Inland Water Ecosystems, looks to extend the study and understanding of freshwater ecosystems. In 2008, Decision IX/19 “strongly supported the need for strengthened international cooperation regarding the allocation and management of water.”⁷⁷ Interestingly, this Annex encourages States to adopt the UN Watercourses Convention discussed above based on the assumption

⁷⁴ *Id.*

⁷⁵ United Nations, Convention on Biological Diversity, (June 5, 1992), <https://www.cbd.int/doc/legal/cbd-en.pdf>.

⁷⁶ *Id.* at art. 6.

⁷⁷ U.N. Secretariat of the Convention on Biological Diversity, *Transboundary Water Resources Management: The Role of International Watercourse Agreements in Implementation of the CBD*, CBD Technical Series No. 40 9 (2008), <https://www.cbd.int/doc/publications/cbd-ts-40-en.pdf>.

that effective water cooperation will assist in ecosystem protection and avoid conflict.⁷⁸

Water dependent wetlands have unique ecosystems that serve many important functions; therefore, it is not surprising that some of the most detailed guidance on water management in international law can be found in a wetlands treaty. The Ramsar Convention on Wetlands of International Importance is an international treaty for the conservation and sustainable utilization of wetlands.⁷⁹ Written in 1971, it went into force in 1975 and currently has 169 contracting parties.⁸⁰

Although Ramsar predates the Rio Conference, the drafters already recognized the “interdependence of Man and his environment.”⁸¹ The Convention text focuses generally on defining wetlands and obligating the signatories to focus on their protection; however, much more detailed guidance is provided in the 21 after-published handbooks. The Ramsar handbooks, which are created after conferences of the contracting parties are held, cover an in-depth range of subjects—including information papers, case studies, and other relevant publications—in order to illustrate key aspects of the guidelines. Handbooks eight, nine, and ten explain the relationship between water management and wetlands protection; suggest water management as part of a larger river basin; and provide policy and guidance for water management respectively. The expertise presented in these handbooks can be applied outside of the Ramsar obligations and beyond wetlands. Many of the recommendations are also useful in the domestic context.

C. Finding the Environment in Domestic Law

In addition to international law, domestic laws can be used to argue that consideration of environmental implications is a customary legal practice. For example, the United States’ Endangered Species Act (ESA) protects endangered or threatened species.⁸² As part of the ESA, species are protected directly through prohibitions on harming or killing a protected species, but species are also protected indirectly

⁷⁸ *Id.* at 10–14 (recognizing that is a particularly sensitive and political topic).

⁷⁹ U.N. Convention on Wetlands of International Importance especially as Waterfowl Habitat, U.N. Doc. No. 14583 (July 13, 1994), http://www.ramsar.org/sites/default/files/documents/library/current_convention_text_e.pdf [hereinafter Ramsar Convention].

⁸⁰ *Id.*

⁸¹ *Id.*

⁸² See generally Endangered Species Act 16 U.S. Code Chapter 35.

through habitat protection rules.⁸³ In fact, destroying or jeopardizing a designated critical habitat carries the same penalties as directly taking a protected animal.⁸⁴ Water is a natural part of the habitat of many plant and animal species; therefore, considering animal impacts when making water decisions is important.

The European Union includes legal restrictions similar to the ESA in the European Commission Habitats Directive. “The Habitats Directive ensures the conservation of a wide range of rare, threatened or endemic animal and plant species.”⁸⁵ The directive states that conservation of natural habitats for targeted species is an essential objective. While obligations specific to water are not enumerated, they are a critical part of many habitats. Some of these same ethics can be seen in the international treaty called the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Another legal means to protect ecosystems as well as the flora and fauna dependent on them is to legally allocate water for their use. While environmental flows are a scientific concept, their implementation is primarily political. At a domestic level, water is allocated to users through a range of legal theories. The challenge is to include environmental needs in the allocation scheme instead of dispensing all waters to human users. This can be accomplished by embedding nature’s need for water with its own special legal standing as seen in South Africa, or by categorizing flows as a beneficial use on par with other water uses as seen in parts of the United States.

In the United States, legal permitting regimes are determined at the state level. Some states limit the distribution of water rights to citizens in order to set aside water for the non-human users of the water body.⁸⁶ Several states have laws in place to protect flows for environmental purposes and many others are working with the United States Geologic Survey to collect data to quantify flow needs in part or all of their

⁸³ U.S. FISH AND WILDLIFE SERV., *Critical Habitat: What is it?* (2015), https://www.fws.gov/endangered/esa-library/pdf/critical_habitat.pdf.

⁸⁴ *Id.*

⁸⁵ European Commission, *Habitats Directive*, at http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm (last visited Apr. 22, 2016).

⁸⁶ *See, e.g.*, *Instream Flows*, State of Washington Dep’t of Ecology, <http://www.ecy.wa.gov/programs/wr/instream-flows/isfhtm.html> (last visited Apr. 22, 2016).

state.⁸⁷ Other countries have made efforts to manage flows within their borders as well. In 1994, the Council of Australian Governments directed all the territories to update their water management to allocate water for environmental benefit.⁸⁸ Later documents increased obligations. Currently, all states have introduced multidisciplinary and holistic techniques for environmental water assessment.⁸⁹

South Africa actually incorporated its water ethic and need for environmental flows into its constitution.⁹⁰ A white paper written to describe the nation's water policy states, "[t]he quantity, quality, and reliability of water required to maintain the ecological functions on which humans depend shall be reserved so that human use of water does not individually or cumulatively compromise the long term sustainability of aquatic and associated ecosystems."⁹¹ This document categorized the water necessary to meet both environmental and basic human needs as "the reserve."⁹² As such, these uses will have priority over all other uses. These and other countries have had a range of success with implementation and efficacy, but their efforts lay a foundation for the expansion of environmental considerations in water management schemes at all levels of government and in future international agreements.⁹³

IV CASE STUDY: U.S./MEXICO

Despite some precedent for including environmental considerations within international water agreements, very few of these agreements make the environment a primary focal point. A recent agreement

⁸⁷ See United States Geologic Survey, *Summary Of Monitoring And Assessments Related To Environmental Flows In USGS Water Science Centers Across The U.S.* (2013), http://water.usgs.gov/coop/enviroflows_summary.pdf (last visited Apr. 22, 2016).

⁸⁸ Rafik Hirji & Richard Davis, *Environmental Flows in Water Resources Policies, Plans, and Projects: Case Studies* 11 (2009).

⁸⁹ Rafik Hirji & Richard Davis, *Environmental Flows in Water Resources Policies, Plans, and Projects: Case Studies* 18 Env'tl Dep't Paper 117 (2009), http://siteresources.worldbank.org/INTWAT/Resources/ENV_Flows_Water_v1.pdf.

⁹⁰ *Id.* at 31–32.

⁹¹ ANTJIE KROG, WHITE PAPER ON A NATIONAL WATER POLICY FOR SOUTH AFRICA app. 1 at 61 (1997), <https://www.dwa.gov.za/documents/Policies/nwpwp.pdf>. The policies reflected in this white paper were enacted into law in the National Water Act of 1998.

⁹² Hirji & Davis, *supra* note 89, at 32.

⁹³ Other international documents that echo the sustainability goals first elucidated in Rio include the United Nations Millennium Development Goals, the 2002 World Summit on Sustainable Development, and goals expressed as part of the UN Water Decade. See U.N. Secretariat *supra* note 77, at 14–17.

between Mexico and the United States is a notable exception. In 2002's Minute 319, the two countries recognized the importance of dedicating water to environmental purposes, and then they did just that. While very exciting news for those who advocated for such a project, it is important to note that the agreement's progressive focus was actually necessitated by a long history of giving preference to human needs to the detriment of the environment.

A. Historic Management of the Colorado River

To understand the current situation on the Colorado River, one must review its history. The mighty Colorado River travels a 1,450-mile journey from its headwaters in the Rocky Mountains south into Mexico. Along the way, seven states and two countries share its waters. In 1922, the U.S. states determined how to divide up the river's waters between themselves in the Colorado River Compact.⁹⁴ When they did so, two major users were not included. The first was Mexico and the second was the environment.⁹⁵

After the Compact, the United States began building a series of dams and canals to deliver water to the states based on the agreement terms.⁹⁶ Among them, Hoover Dam was completed in 1935 followed by Davis, Parker, Imperial, and half a dozen others.⁹⁷ Through these changes, Mexico experienced a substantial decrease in water deliveries making it difficult to meet their needs.⁹⁸

After years of insistence by Mexico that its rights to water were being ignored, the United States and Mexico signed the Treaty Relating to the Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande on February 3, 1944 (1944 Treaty).⁹⁹ The two nations

⁹⁴ Colorado River Compact (1992), <https://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf> (last visited Apr. 22, 2016).

⁹⁵ Jonathan S. King et al., *Getting to the Right Side of the River: Lessons for Binational Cooperation on the Road to Minute 319*, 18 U. DENV. WATER L. REV. 36, 50 (2014).

⁹⁶ Nicole Ries, *The (Almost) All-American Canal: Consejo de Desarrollo Economico de Mexicali v. United States and the Pursuit of Environmental Justice in Transboundary Resource Management*, 35 ECOLOGY L.Q. 493, 496 (2008); Jennifer Pitt et al., *Two Nations, One River: Managing Ecosystem Conservation in the Colorado River Delta*, 40 NAT. RESOURCES J. 819, 826 (2000).

⁹⁷ Pitt et al., *supra* note 96, at 826.

⁹⁸ Ries, *supra* note 96, at 499–500.

⁹⁹ Alberto Szekely, *How to Accommodate an Uncertain Future into Institutional Responsiveness and Planning: The Case of Mexico and the United States*, 33 NAT. RESOURCES J. 397, 397 (1993); King et al., *supra* note 95, at 60.

continue to build on the 1944 Treaty through amendments called “minutes.”¹⁰⁰ The 1944 Treaty defines the quantity of Colorado River water to be delivered to Mexico by the United States. The Treaty states that 1.5 million acre-feet of water annually must reach the Mexican border to meet bi-national salinity standards.¹⁰¹ Any surplus quantities that arrive at the Mexico point of delivery cannot exceed a total delivery of 1.7 million acre-feet.¹⁰² During drought, deliveries to Mexico can be reduced in proportion to reduction of U.S. use.¹⁰³ The treaty further provides that “Mexico shall acquire no right beyond that provided by this subparagraph by the use of the waters of the Colorado River system, for any purpose whatsoever, in excess of 1,500,000 acre feet . . . annually.”¹⁰⁴

Delivery of these waters were to occur through dams and canals on both sides of the border.¹⁰⁵ One of these was the All-American Canal (AAC). Completed in the 1940s, its origins reach back to the Boulder Canyon Project Act of 1928. This Act authorized the construction of canals to control the flow of the Colorado River and facilitate deliveries according to the Compact.¹⁰⁶ The AAC is one of the world’s largest irrigation canals running eighty miles, carrying 3.1 million acre-feet of water.¹⁰⁷ Its purpose is to carry water from the Colorado River to nine cities and 500,000 acres of farmland in the agriculturally rich California Imperial Valley.¹⁰⁸ At the time of its construction, it was made of earthen porous material. Although the title indicates that it provides water only for the United States, the reality was quite different. For over sixty years, considerable amounts of water seeped from this

¹⁰⁰ MINUTES BETWEEN THE UNITED STATES AND MEXICAN SECTIONS OF THE IBWC, http://www.ibwc.state.gov/Treaties_Minutes/minutes.html (last visited Apr. 22, 2016).

¹⁰¹ Treaty Relating to the Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, Mex.-U.S., Nov. 14, 1944, 59 Stat. 1219.

¹⁰² *Id.*

¹⁰³ *Id.*

¹⁰⁴ *Id.*

¹⁰⁵ *Id.* at art. 11–12.

¹⁰⁶ Boulder Canyon Project Act, Pub. L. No. 642-70 (1928), <https://www.usbr.gov/lc/region/pao/pdfiles/bcpact.pdf>; Erin K. Bradley, *California Draining: Lining the American Canal*, 12 GREAT PLAINS NAT. RESOURCES J. 36, 39 (2007–2008).

¹⁰⁷ Ries, *supra*, note 96, at 496.

¹⁰⁸ *Id.* at 493. Without the influx of this water, the Imperial Valley is an “arid geologic sink.” *Id.* at 495. California first identified the Imperial Valley as a potential agricultural site in the 1850s. King et al., *supra*, note 95, at 46. Currently, the Imperial Valley is the world’s top alfalfa growing region. *Id.* at 53.

earthen canal into northern Mexico where it was extracted and used by local farmers.¹⁰⁹

While the 1994 Treaty included water quantity terms, it did not speak to water quality obligations. Consequently, additional issues emerged throughout the years. This reached a peak in the 1960s when the United States began filling its newly constructed reservoirs.¹¹⁰ During this time, only the minimum amount of water required was delivered to Mexico.¹¹¹ This reduction in flows caused the salinity of delivered water to increase making it unusable for agriculture.¹¹² After citizens pursued a series of self-help solutions on both sides of the border, State leaders finally came together in 1973 to sign Minute 242.¹¹³ Minute 242 added water quality obligations to the 1944 Treaty delivery obligations.¹¹⁴

A few decades later, more water issues arose. Rapid population growth in California created a need to find more water. In the 1980s and 1990s, the perception that water could be more efficiently managed as a commodity took hold. This significantly impacts the equity of distribution to current users of existing water sources.¹¹⁵ Rather than historic use or need-based distribution, water is increasingly allocated to those who can pay for access. This tends to be urban cities and large-scale users rather than individual agricultural users.¹¹⁶ Allowing water to be distributed in this way is not ideal because users can prioritize use decisions based on monetary value instead of emphasizing equity among users.¹¹⁷

One response to this concerning development is the 1988 Congressional legislation titled the San Luis Rey Indian Water Rights Settlement Act, which authorizes the Secretary of the Interior to choose a method that would recapture the seepage “lost” to Mexican users

¹⁰⁹ Ries, *supra* note 96. It is estimated that the use of these “lost” waters support 1.3 million Mexicali residents. *Id.*

¹¹⁰ King et al., *supra* note 95, at 62.

¹¹¹ *Id.* at 62–63.

¹¹² *Id.* at 63.

¹¹³ *Id.*

¹¹⁴ *Id.* at 64. The formula used to calculate acceptable salinity ensured that Mexican farmers were not receiving an inferior water quality to that used by the Imperial Valley farmers. *Id.*

¹¹⁵ Alfonso Cortez-Lara & Maria Rosa Garcia-Acevedo, *The Lining of the All-American Canal: The Forgotten Voices*, 40 NAT. RESOURCES J. 261, 267, 273 (2000).

¹¹⁶ *Id.* at 269, 271.

¹¹⁷ *Id.*

from the AAC.¹¹⁸ In the early 2000s, California agreed to line an additional twenty-three miles of the AAC as a way to reduce their usage of Colorado River water.¹¹⁹ The U.S. government authorized concrete lining of the AAC in order to better manage surface water distribution within the United States.¹²⁰ The change was projected to prevent seepage and reclaim 67,000 acre-feet of “lost” Colorado River water in order to “conserve” the water and bolster supply to southern Californians.¹²¹ The lining was completed in 2009.¹²²

Lining of the All-American Canal highlights the looming transboundary challenges associated with concrete lining and the effects such lining can have on international communities (e.g. Mexican towns rooted in agricultural development dependent on the Mexicali Valley Aquifer).¹²³ Early into the project, apprehension set in that the lining project would have significant effects on groundwater recharge to the Mexicali Valley Aquifer, which supplies water to Mexican users for agriculture and domestic purposes.¹²⁴ A study conducted in 1972 by the Mexico Ministry of Hydrology found that “the Mexicali Valley Aquifer receives an annual recharge of 70 million cubic meters (Mm³) from the All-American Canal.”¹²⁵

Prompted by this concern regarding the effects of the lining project, a group of community members and environmentalists brought suit against the Bureau of Reclamation (BOR) in 2006.¹²⁶ The plaintiffs pleaded to halt the project and asserted that the BOR ought to more

¹¹⁸ Ries, *supra* note 96, at 497.

¹¹⁹ *Id.* at 497.

¹²⁰ Cortez-Lara & Garcia-Acevedo, *supra* note 115, at 262.

¹²¹ Ries, *supra* note 96.

¹²² *Id.* at 497.

¹²³ See Cortez-Lara & Garcia-Acevedo, *supra* note 115, at 262, 269. (stating that, “this project will seriously diminish the inflows of groundwater in the Mexicali Valley . . . [and that] the construction of water as a commodity has brought an array of new challenges to agricultural water users in the Mexicali Valley”). See also Bradley, *supra* note 106, at 38 (contending that “[t]he proposed lining project eliminates the current seepage that replenishes water to regional aquifers and concomitantly provides an essential source of water for numerous farmers”).

¹²⁴ See Ries, *supra* note 96 (explaining that for seventy years prior to the lining, farmers in the Mexicali Valley have “built an agricultural and industrial economy in the Valley, which supports the livelihood of nearly 1.3 million Mexicali residents”). See also Consejo de Desarrollo Economico de Mexicali v. United States, 482 F.3d 1157, 1163 (9th Cir. 2007) (considering the assertion that residents of the Mexicali Valley have expended “considerable resources to create an infrastructure. . . [to] deliver water for drinking and irrigation. . . [and] that a large metropolitan community has developed in reliance on the water”).

¹²⁵ Cortez-Lara & Garcia-Acevedo, *supra* note 115, at 262.

¹²⁶ Consejo de Desarrollo Economico de Mexicali v. United States, 482 F.3d at 1166.

adequately consider the impending environmental effects.¹²⁷ However, while the case was on appeal in the Ninth Circuit, Congress passed legislation “mandating that the project proceed ‘without delay.’”¹²⁸ The Court vacated the plaintiffs’ claims¹²⁹ based on that legislation and the 1944 Treaty that apportioned water between Mexico and the United States.¹³⁰

Researchers concluded that concrete lining prevents water seepage that could otherwise recharge underlying aquifers and wells used for agricultural irrigation.¹³¹ Restricting water seepage can reduce groundwater quality in local aquifers, surrounding wells, as well as surface water flows.¹³² The lack of freshwater inflows increases salinity rise within the aquifer and can render it unusable.¹³³ For example, increased salinity of water used for irrigation can permanently ruin crops and otherwise fertile agricultural land,¹³⁴ consequently negatively impacting the livelihood of agricultural users of that water source.

The impacts seen at the Mexico border are not unique. A study conducted in the town of Suriyawewa, Sri Lanka, tested water quality of surrounding wells before and after rehabilitation (lining) of the Uda Walawe irrigation system, next to which residents dug wells for domestic use.¹³⁵ The study concluded that the rehabilitation program threatens the quality of sources of domestic water and consequently the health of the users of such water.¹³⁶ Tests showed an increase of salinity to levels “above the national standard for drinking water” as well as an

¹²⁷ *Id.*

¹²⁸ Ries, *supra* note 96, at 494; Tax Relief and Health Care Act of 2006 § 395(a), Pub. L. No. 109-432, 120 Stat. 2922 (2006).

¹²⁹ Consejo de Desarrollo Economico de Mexicali v. United States, 482 F.3d at 1174; Ries, *supra* note 96, at 494.

¹³⁰ Treaty Relating to the Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, Nov. 14, 1944, and Supplementary Protocol, U.S.-Mex., 59 Stat. 1219.

¹³¹ Bradley, *supra* note 106, at 38.

¹³² See Ries, *supra* note 96, at 502 (recognizing that “without the seeping water from the AAC to dilute the water in the aquifer which contains more saline, the quality of irrigation water mined from wells is expected to degrade considerably”). See also Cortez-Lara & Garcia-Acevedo, *supra* note 115, at 272 (pointing out that due to the lining of the AAC surface water flows via the La Mesa Canal would contain an increased salt content).

¹³³ Ries, *supra* note 96, at 502.

¹³⁴ Cortez-Lara & Garcia-Acevedo, *supra* note 115, at 273.

¹³⁵ Eline Boelee & Wim van der Hoek, *Impact of Irrigation on Drinking Water Availability in Sri Lanka*, INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE (2002).

¹³⁶ *Id.* at 13.

increase in harmful bacteria throughout the distribution system.¹³⁷ The researchers posited a compromise, suggesting that “[i]f canal lining would be interrupted in settlement areas, shallow wells would continue to be recharged with canal seepage.”¹³⁸ In addition to the concern of increased salinity and bacteria, the impending negative effects of concrete lining also involves more expansive environmental consequences.

Additional negative consequences linked to the AAC include damage to the overall hydrological development with regards to the restriction of seepage in the Colorado River System and flow of water to the Colorado River Delta.¹³⁹ After visiting the Delta in 1922, famed naturalist Aldo Leopold described his experience as, “[v]erdant walls of mesquite and willow . . . a hundred green lagoons. The river was everywhere and nowhere.”¹⁴⁰ Unfortunately, the lush world that Leopold enjoyed was destroyed by changes made to the Colorado River upstream.¹⁴¹ In its prime the delta’s alluvial fan spanned across two million acres.¹⁴² Within one of the world’s largest desert estuaries were “vast riparian and tidal wetland the size of the state of Rhode Island.”¹⁴³ Within twenty short years of his visit, most of the wildlife had vanished along with the ecosystem that supported it.¹⁴⁴ Now, the Colorado River Delta has been reduced to approximately 150,000 acres of wetlands that remain in part due to a mistake, and the once mighty river no longer reaches the Gulf of California.¹⁴⁵

¹³⁷ *Id.* at 7–8.

¹³⁸ *Id.* at 13.

¹³⁹ Ries, *supra* note 96, at 502.

¹⁴⁰ Joby Warrick, *A River Once Ran Through It*, <https://www.nwf.org/News-and-Magazines/National-Wildlife/News-and-Views/Archives/2002/A-River-Once-Ran-Through-It.aspx> (last visited Apr. 22, 2016).

¹⁴¹ After the Hoover Dam was completed in 1935, the flow of the river was greatly reduced for six years as the Lake Mead reservoir was allowed to fill. Davis, *supra* note 8. Later, the river’s flow was again stopped for seventeen years to fill Lake Powell. *Id.*

¹⁴² Pitt et al., *supra* note 96.

¹⁴³ Davis, *supra* note 8. “As most of the river’s flow reached the Delta, freshwater, silt, and nutrients helped create a complex system of wetlands that provided feeding and nesting grounds for birds, and spawning habitat for fish and crustaceans.” Pitt et al., *supra* note 96.

¹⁴⁴ Davis, *supra* note 8.

¹⁴⁵ Even with the significant reduction, the Delta is the largest remaining wetland system in the southwest region of North America. Pitt et al., *supra* note 96. The remaining La Ciénega de Santa Clara, a wetland stretching 40,000 acres, was created accidentally by agricultural wastewater runoff. Sandra Postel, *The Accidental Wetland in the Colorado Delta*, NAT’L GEOGRAPHIC (Apr. 2, 2013), <http://voices.nationalgeographic.com/2013/04/02/the-accidental-wetland-in-the-colorado-delta/>. Additional flood events also assisted in

Additional degradation of the Colorado River Delta and the surrounding wetlands, forests and lagoons is expected as a result of hydrological engineering of the Colorado River System.¹⁴⁶ Concrete lining causes localized effects along the banks of canals and devastates wetlands that depend on seepage.¹⁴⁷ For example, “wetland vegetation on Mexicali’s Andrade Mesa grows along the canal and provides habitat for various species of wildlife.”¹⁴⁸ The shift to channelization in general has resulted in significant coastal wetland losses.¹⁴⁹ Loss of wetlands is concerning because wetlands provide erosion and flood control and also contribute to recharging underground aquifers.¹⁵⁰

Concrete lining not only affects water quantity, it can also impact water quality by carrying pollutants as a result of the impervious nature of concrete.¹⁵¹ Impervious materials, such as concrete, are used in various kinds of development to cover land and are generally impenetrable by water.¹⁵² This impermeable quality and widespread use of such cover in land use development has catapulted impervious cover above point source discharges and sewage treatment plants as the leading cause of water quality degradation in the United States.¹⁵³

The reason behind this is that “impervious cover prevents the natural filtration of precipitation and water flows that would occur if the water were to fall or flow over permeable soils.”¹⁵⁴ Instead of seeping into the soil, impervious cover causes water from rainfall to increase in velocity as it flows across the ground, picking up sediment and pollutants along the way.¹⁵⁵ The increased movement of polluted water threatens the integrity of the entire watershed and the ecosystems within it.¹⁵⁶

limited wetlands survival when vegetation sprung up from the dirt after the water subsided. King et al., *supra* note 96, at 68–69.

¹⁴⁶ Ries, *supra* note 96, at 502.

¹⁴⁷ *Id.* at 503.

¹⁴⁸ *Id.*

¹⁴⁹ ENVIRONMENTAL QUALITY ANNUAL REPORT OF THE COUNCIL OF ENVIRONMENTAL QUALITY 97 (1993).

¹⁵⁰ *Id.* at 96.

¹⁵¹ Craig Anthony Arnold, *Clean-Water Land Use: Connecting Scale and Function*, 23 PACE ENVTL. L. REV. 291, 294 (2006).

¹⁵² *Id.*

¹⁵³ *Id.* at 295.

¹⁵⁴ *Id.*

¹⁵⁵ *Id.*

¹⁵⁶ *See id.* at 295, 297 (explaining that organic waste, fertilizers, and other urban runoff can deplete oxygen causing fish kills in the receiving ecosystem).

Waterways, such as canals, that are lined with impervious material facilitate the same kind of devastating result as other urban uses for the cover.¹⁵⁷ Because concrete lining of canals is impervious, the pollutants and sediment that end up in the canals cannot be filtered out (through seepage) and therefore are carried out into larger streams, lakes, or the ocean, which ultimately causes significant water quality degradation in the destination water body.¹⁵⁸ Therefore, concrete lining can thwart seepage in a way that adversely impacts surrounding wetlands¹⁵⁹ and, because of the impermeability of the lining, results in water that is more likely to be filled with pollutants.¹⁶⁰

B. The Divergence: Minute 319

As evidenced by the historic distribution and canalization of the Colorado River, the environment and ecosystems were never a priority for water allocation. An earthquake, advocacy, and a little luck changed that. Minute 319 finds its start in Minute 318. On April 4, 2010, a 7.2-magnitude earthquake shook Calexico and the Mexicali Valley.¹⁶¹ Among the destroyed items were many irrigation canals in Mexico's Irrigation District 014 that delivered Colorado water from the U.S.-Mexico border to the Mexican farmers.¹⁶² Because deliveries were severely impaired, the Mexican government asked that its portion of water be stored on the United States side until repairs could be made. The result of that request was Minute 318. In Minute 318, the United States agreed to defer delivery for three years up to 260,000 acre-feet of Mexico's Colorado River allotment by storing it in upstream reservoirs.¹⁶³ When Minute 318 was completed, participating parties

¹⁵⁷ See *id.* at 295 (showing that lined waterways are one of the many contributors to devastating impacts resulting from the broad scheme of impervious cover usage).

¹⁵⁸ *Id.*

¹⁵⁹ Ries, *supra* note 96, at 494.

¹⁶⁰ Arnold, *supra* note 151, at 295.

¹⁶¹ Katie Orr, *7.2 Earthquake Rocks Mexicali, San Diego Region*, KPBS (Apr. 5, 2010), <http://www.kpbs.org/news/2010/apr/05/72-earthquake-rocks-mexicali-san-diego-region/>.

¹⁶² Amy Isackson, *Mexicali Earthquake Reshapes Lives And Landscape*, KPBS (Apr. 25, 2010), <http://www.kpbs.org/news/2010/apr/25/mexicali-earthquake-reshapes-lives-and-landscape/>. Specifically, the concrete lined Nuevo Delta Canal and the Reforma Canal, which moves water from the Colorado River in to the Nuevo Delta Canal at Morelos Dam were severely damaged. Buono & Eckstein, *supra* note 37.

¹⁶³ INT'L BOUNDARY & WATER COMM'N, MINUTE 318, ADJUSTMENT OF DELIVERY SCHEDULES FOR WATER ALLOTTED TO MEXICO FOR THE YEARS 2010 TO 2013 AS A RESULT OF THE INFRASTRUCTURE DAMAGE IN IRRIGATION DISTRICT 014 RIO COLORADO CAUSED BY THE APRIL 2010 EARTHQUAKE IN THE MEXICALI VALLEY, BAJA CALIFORNIA (2010), http://www.ibwc.gov/Files/Minutes/Min_318.pdf.

recognized that more work needed to be done to maximize Colorado River management.¹⁶⁴

In 2012, as part of the 2010 commitment to reassess, International Boundary and Water Commission (IBWC) commissioners met to address international joint cooperation measures regarding preservation and management in the Colorado River Basin.¹⁶⁵ The Commission set out to consider several issues, including “the impacts of potential Colorado River shortage conditions . . . investing in infrastructure such as desalinization facilities; [conservation of] water through investments in a variety of current and potential uses, [including] the possibility of permitting Mexico to use United States infrastructure to store water.”¹⁶⁶ The resulting agreement was Minute 319.¹⁶⁷

Though many issues were addressed in Minute 319, a major reason for the Minute was to assist in the rehabilitation of Mexico’s damaged water distribution system still in disarray from the 2010 earthquake.¹⁶⁸ Some of the U.S. investment in Mexico’s infrastructure involves lining damaged canals with concrete.¹⁶⁹ One such lining project will be on the Canal Revolución, which has a hefty price tag of \$18 million for lining a 10-mile stretch.¹⁷⁰ Minute 319 extends Minute 318’s commitment to store Mexico’s water for an additional four years. Mexico is free to request any banked water under Minute 318, including compensation for any delivery reductions during times of low water.¹⁷¹

An important result of this agreement is a more flexible system in times of water surplus, which encourages conservation. Under Minute 319, Mexico can defer delivery of water that has been saved through conservation or because an alternate source was used.¹⁷² Essentially, this term removes the take or pay aspect of the 1944 Treaty. Under the original provisions, the annual water delivery was obligated and,

¹⁶⁴ Buono Eckstein, *supra* note 37.

¹⁶⁵ INT’L BOUNDARY & WATER COMM’N, *supra* note 5.

¹⁶⁶ *Id.*

¹⁶⁷ *Id.*

¹⁶⁸ *Id.*

¹⁶⁹ Buono & Eckstein, *supra* note 37, at 8.

¹⁷⁰ See Dibble & Fikes, *supra* note 37 (discussing the source of funding for the project from the Bureau of Reclamation, the Metropolitan Water District of Southern California, Southern Nevada Water Authority, and the Central Arizona Project).

¹⁷¹ INT’L BOUNDARY & WATER COMM’N, *supra* note 5.

¹⁷² *Id.* There is a quantity limit to this provision of 250,000 acre-feet. *Id.*

because Mexico had no storage mechanism, there was no incentive to not use all of the water delivered. With this added flexibility, Minute 319 also creates a more cooperative approach for how the two countries manage shortages and surpluses.

Perhaps the most exciting aspect of Minute 319 is Section III.6, entitled “Water for the Environment and ICMA/ICS Exchange Pilot Program.” This section recognizes the ecological importance of the once expansive Colorado River Delta by providing “environmental flows to benefit the riparian ecosystem and as a part of that effort a pulse flow will be implemented to the Colorado River Delta.”¹⁷³ The water will come from a few sources. First, in exchange for the United States contributing \$21 million in capital for canal improvements, Mexico will grant a one-time allotment of 124,00 acre-feet from their water in storage.¹⁷⁴ From this, the United States will contribute two-thirds of the instream flows (generated through water savings by canal efficiency upgrades), and the nonprofit organization Colorado River Delta Water (CRDW) will supply the remainder from water rights it purchased. Water will be provided in the form of a one-time, high-volume pulse flow of about 105,400 acre-feet to mimic a natural snowmelt event.¹⁷⁵ Base flows, provided by the CRDW, will be released more slowly over the next five years. The hope is that, in addition to expanding wetland habitat, the Colorado would again reach the Gulf of California.¹⁷⁶

While this pilot project arguably will not sustain vital vegetation along the banks of the canal over the long term, it is still a very important step forward. On March 23, 2014, the gates of the Morelos Dam at the Arizona-Mexico border opened allowing Colorado water to start its final seventy-mile journey as a planned pulse flow.¹⁷⁷ The water

¹⁷³ *Id.*

¹⁷⁴ *Id.*

¹⁷⁵ Brian Howard Clark, *Historic “Pulse Flow” Brings Water to Parched Colorado River Delta*, NAT’L GEOGRAPHIC (Mar. 24, 2014), <http://news.nationalgeographic.com/news/2014/03/140322-colorado-river-delta-pulse-flow-morelos-dam-minute-319-water/>. Although this pulse flow is more water than has flowed there in decades, it represents less than one percent of the pre-dam annual flow. *Id.*

¹⁷⁶ Much of the credit for this pilot project must be given to the environmental organizations and research scientists who continued to work in this area and advocate for its importance. See David Owen, *Where the River Runs Dry*, THE NEW YORKER (May 25, 2015), <http://www.newyorker.com/magazine/2015/05/25/the-disappearing-river>; Pitt et al., *supra* note 96.

¹⁷⁷ MINUTE 319 COLORADO RIVER DELTA ENVIRONMENTAL FLOWS MONITORING: INITIAL PROGRESS REPORT (2014) [hereinafter 2014 Report].

release lasted for eight weeks and inundated 5,000 acres; on May 15, the river reached the sea for the first time in half a century.¹⁷⁸

Studies completed after the flooding found that surface water reached the Gulf of California and that the water table rose temporarily before declining after its peak.¹⁷⁹ Additionally, preliminary observations showed an increase in native and non-native vegetation germination, while effects on birds in the area seemed to exhibit little change.¹⁸⁰ In areas with existing vegetation, there was a 43% increase in green vegetation in places the pulse flow inundated, and a 23% increase in the broader riparian area.¹⁸¹ New vegetation was also observed in areas that received very little surface water.¹⁸² Scientists believe this may be due to increased groundwater from the pulse flow.¹⁸³ Preliminary findings substantiate the resilience of these ecosystems if they are given a chance. Minute 319 demonstrates that humanity can find more success working with nature than against it and sharing international waters with the environment in mind can bridge cultural divides.¹⁸⁴

V

RECOMMENDATIONS/BEST PRACTICES

Sharing water across international borders is not easy. Sovereignty issues often play out through the pursuit of political and economic dominance instead of focusing on long-term sustainability. Communities depend on the natural environment for a range of things such as food, spiritual needs, aesthetics, and agriculture. Negotiating states must consider these interdependencies if they are to properly represent their citizens in an international agreement. One way to do this is to include ecologically based terms, including environmental flow provisions, in every transboundary water agreement. Including these terms and increased public involvement in their development will

¹⁷⁸ Sarah Zielinski, *The Colorado River Delta Turned Green After a Historic Water Pulse*, SMITHSONIAN.COM (Dec. 18, 2014), <http://www.smithsonianmag.com/science-nature/colorado-river-delta-turned-green-after-historic-water-pulse-180953670/?no-ist>.

¹⁷⁹ 2014 Report, *supra* note 177.

¹⁸⁰ *Id.*

¹⁸¹ Zielinski, *supra* note 178.

¹⁸² *Id.*

¹⁸³ *Id.*

¹⁸⁴ See Rowan Jacobsen, *The Day We Set the Colorado Free*, OUTSIDE (June 10, 2014), <http://www.outsideonline.com/1928261/day-we-set-colorado-river-free>.

better position the economies and environments of State participants into the future.

A. *Treat the System*

One of the shortfalls of many international water agreements is their myopic focus on the shared water body without considering the water body's relationship with the surrounding area. The first step in any successful water management project is to view a water body as part of a larger system. This might include connected groundwater, estuaries, wetlands, or domestic tributaries.¹⁸⁵ Planning for this broader water ecosystem adds complexity in the short term, but it better positions the participating States for success over the long-term.¹⁸⁶

Facilitating greater integration between the sciences of ecology and hydrology is needed for sustainable river or groundwater basin management because this integration explains how catchments function.¹⁸⁷ “The concept of ‘connectivity’ is emerging as an important theme in current approaches to understanding hydrology and catchment scale ecological processes.”¹⁸⁸ One approach to basin wide management is to look at important ecological habitats associated with the water in question. This is particularly important when there are economic dependencies on collocated species. For example, if there is a fragile ecosystem in one State dependent on an international water resource, water quantity and water quality must be considered as a critical component of water sharing even when all parts of that system are not international.

The Mekong Agreement is an excellent example of a basin approach effort. The signatory States to this agreement are dependent on the river for many non-navigational needs, including subsistence fishing. Recognizing this, the Agreement includes flow conditions to protect species dependent on these interrelated waters. While the Mekong River is international, the interrelated Tonlé Sap Lake is located entirely within Cambodia.¹⁸⁹ Tonlé Sap is a seasonally inundated

¹⁸⁵ Adreman et al., *supra* note 9, at 437.

¹⁸⁶ See King et al., *supra* note 95, at 103 (describing how neglecting the environment on the Colorado River caused many negative effects).

¹⁸⁷ D. Tetzlaff et al., *Connectivity Between Landscapes and Riverscapes—a Unifying Theme in Integrating Hydrology and Ecology in Catchment Science?*, 21 *HYDROL. PROCESS.* 1385, 1385 (2007).

¹⁸⁸ *Id.*

¹⁸⁹ Chris Berdik, *Of Fish, Monsoons, and the Future*, N.Y. TIMES (June 9, 2014), http://www.nytimes.com/2014/06/10/science/of-fish-monsoons-and-the-future.html?_r=0.

freshwater lake connected to the Mekong River by the 75-mile Tonlé Sap River.¹⁹⁰ These three water bodies function as one ecosystem. During the wet season, the Tonlé Sap River flows to the lake from the Mekong and it reverses its flow other times of the year.¹⁹¹ During the monsoons, the lake swells up to five times its dry season size.¹⁹² This lake is home to one of the world's most varied and productive ecosystems, so the region is a critical source of Cambodia's food provisions.¹⁹³ One hundred bird varieties and 200 fish species depend on these waters, some of which are threatened or endangered.¹⁹⁴ Because of this relationship, the lake was included in the Mekong Agreement, which demonstrates a consensus among its signatories that the health of the shared resource was dependent on the related waters.

In order to achieve environmental protection and promote sustainability, States must first set their objectives and agree on future desired conditions. Objectives can be as general as wanting to protect the health of a related system, such as in the Mekong described above. They can also be more detailed and focus on the protection of select species or wetland areas. "Better cooperation also entails identifying clear yet flexible water allocations and water quality standards, taking into account hydrological events, changing basin dynamics and societal values."¹⁹⁵ Regardless of the goal, achievement will likely be predicated on understanding the science of how the goal can be accomplished and writing an agreement accordingly.

Other international documents also support the need to manage the basin as a whole. The Watercourse Convention defines a watercourse as "a system of surface waters and groundwaters" thus increasing the watercourses that are considered international as well as integrating management of one with the others. Both the Watercourse Convention and the Rio Declaration urge expansion of the administrative approach by integrating ecosystem considerations into decision-making protocols. International and domestic law that protect endangered and

¹⁹⁰ *Id.*

¹⁹¹ CANBY PUBLICATIONS, *Tonle Sap Lake & Prek Toal Bird Sanctuary*, <http://www.canbypublications.com/siemreap/srtonlesap.htm> (last visited Apr. 22, 2016).

¹⁹² *Id.*

¹⁹³ Berdik, *supra* note 189.

¹⁹⁴ CANBY PUBLICATIONS, *supra* note 191.

¹⁹⁵ UNITED NATIONS, *Transboundary Waters*, http://www.un.org/waterforlifedecade/transboundary_waters.shtml (last updated Oct. 23, 2014).

threatened species also implicate habitat protection, which frequently includes minimum water requirements.

Sustainability of a water resource is closely tied to smart and responsible growth. As such, any sharing agreement must consider this relationship when dividing the waters to grant or prescribing uses. One important criterion to include is dedicated water for the environment.

B. Don't Forget the Flows

While environmental flows generally fall within the purview of the basin wide approach advocated above, its importance dictates further exploration. In addition to providing a host of ecosystem services such as freshwater, food, and hydropower, rivers create a critical link to the sea. This link has navigational and non-navigational importance. From a non-navigational perspective, the water provides a pathway for migration for many fish species. Also, the addition of freshwater to a saline environment provides habitat for many ecologically important marine species. Unfortunately, these scientific realities are often overlooked by decision-makers motivated by politics or short-range economic gains, and this jeopardizes future economic sustainability.¹⁹⁶ Nations cannot allow all the waters to be appropriated, leaving a dry riverbed.¹⁹⁷

One alternative is to include environmental flows provisions in international water agreements or, at the very least, avoid terms that encourage water to be diverted from the environment. Inflexible numeric allocations and delivery obligations often promote over-engineering and place human needs above nature's. Over the long-term, this will negatively affect human users as well.¹⁹⁸ In agreements completed before the importance of flows was understood, cooperative review and amendments may be appropriate.¹⁹⁹ The Colorado River provides a good example of the ability to revisit and update old

¹⁹⁶ "The very great number of international rivers and river basins on today's maps of the world attest to the fact that watercourses have more often been regarded throughout history as convenient and well-delineated political frontiers than as part of the natural resource common to many users, human and non-human." Ludwik A Teclaff, *Evolution of the River Basin Concept in National and International Water Law*, 36 NAT'L RES. J 359, 361 (1996).

¹⁹⁷ See King et al., *supra* note 95, at 99–100 (discussing several rivers around the world that have been almost destroyed by overuse).

¹⁹⁸ Clark, *supra* note 175.

¹⁹⁹ King et al., *supra* note 95, at 100–01.

agreements to reflect modern understandings and needs while still respecting the underlying allocation terms.

When water is set aside for the environment, it needs to be done in a way that supports a flow regime rather than a minimum flow standard.²⁰⁰ “The goal . . . is to maintain flows in order to protect the ecological, chemical and physical integrity of river systems.”²⁰¹ Scientific data clearly supports the theory that a healthy river is one that consists of a range of flows including a base flow and occasional pulse flows.²⁰² Examining seasonal shifts in conjunction with how and when communities need the water can allow for some creative solutions to nature’s needs.

Environmental flow terms must be based on local conditions. All rivers are not created equal. Climate, population, and ecological diversity can significantly impact what a river requires. As population increases and climate change alters local conditions, additional stress will be put on water resources. Because of the increasing amount of unknowns, building flexibility into terms is important.²⁰³ Advanced planning and understanding of local systems can play a critical role in both avoiding conflict and ensuring economic success.

C. Partner with the Public

Effective basin-wide and flows projects require an understanding of natural systems that States often do not have; therefore, inclusion of non-state actors is an important component to success. Seeking input from stakeholders helps avoid conflict. “Potential transboundary impacts and conflicting interests can best be solved by cooperation, adequate legal and institutional frameworks, joint approaches to planning and sharing of benefits and related costs.”²⁰⁴

The Rio Declaration states that effective public participation occurs when the States facilitate and encourage public awareness and input by making information readily available. At a minimum, information about the environment (including any concerns that may exist) must be

²⁰⁰ See discussion *supra* Part II.

²⁰¹ Albert E. Utton & John Utton, *The International Law of Minimum Stream Flows*, 10 COLO. J. INT’L ENVTL. L. & POL’Y 7, 7 (1999).

²⁰² See discussion *supra* Part II.

²⁰³ King et al., *supra* note 95, at 100.

²⁰⁴ UN WATER, *supra* note 1.

made public. There must also be effective access to administrative proceedings, including redress and remedy when needed.²⁰⁵

The public should participate in setting future goals for the river or water body. Studies have shown that agreement on an end goal can reduce fear and encourage participation of water users in implementation processes.²⁰⁶ Science is only one part of implementing a flows regime. Implementation also requires an understanding of social, economic, political, and technical issues, as well as stakeholder buy-in.²⁰⁷ Those living in an area often have the greatest understanding of a water body's complexities and needs. They are also the individuals who will be most affected by any agreement, so including their needs and concerns is critical. Involving the public also creates a sense of project ownership, which increases participation later and prevents conflict.²⁰⁸ Because of their importance, public education is an important component to ensure early participation. The Convention of Biologic Diversity discusses the needs for public education and awareness.²⁰⁹ If communities are taught the importance of the ecosystem and how their actions can negatively affect it, they are less likely to make harmful decisions.

Contributions and participation of environmental nonprofits were critical in the achievements seen in Minute 319.²¹⁰ “[T]he process leading to Minute 319 offers valuable lessons on collaboration and the importance of comprehensive stakeholder inclusion that is likely a necessary element of any healthy river basin management regime.”²¹¹ Without the scientific understanding of the system and continued advocacy, that project may not have come to fruition. In that case, an agreement that contained no environmental provisions was already in place. The ability to revisit those terms fifty years later and incorporate an environmental component was the result of years of scientists studying and collecting data to prove that the remaining ecosystems were important enough to support.²¹² Scientists partnered with nonprofits, like Environmental Defense Fund, which specializes in

²⁰⁵ United Nations Environment Programme, Rio Declaration on Environment and Development, Principle 10, <http://www.unep.org/documents.multilingual/default.asp?documentid=78&articleid=1163>.

²⁰⁶ Adreman et al., *supra* note 9, at 438–39.

²⁰⁷ *Id.* at 442.

²⁰⁸ UN WATER, *supra* note 1, at 9.

²⁰⁹ United Nations, *supra* note 75, at art. 13.

²¹⁰ King et al., *supra* note 95, at 83, 84, 101–02.

²¹¹ *Id.* at 101.

²¹² *Id.* at 101–02.

bridging the gap between scientists and policymakers to look for opportunities for change. The relationships built over years between these organizations and the IBWC created a partnership atmosphere where change was possible.

CONCLUSION

There are over five hundred internationally shared water bodies across the world. Each of these provides opportunities for conflict as well as cooperation. Which one occurs is entirely dependent on the foresight of the State participants. First, States need to come together to determine a use and allocation agreement for their shared water. One aspect of this discussion must be how the water is currently being used. Historically, this part of the data gathering and subsequent agreement focused only on human usage of water. This is a mistake if the goal of the agreement is continued sustainability and economic success of the signatory States. To achieve this goal, more must be considered.

Humans are not the only users of water. Water is also utilized by related ecosystems. Therefore, to truly achieve a successful agreement, States must assess the local natural environment and quantify how their countries benefit from the ecosystems services it provides. Accuracy in this endeavor depends heavily on scientific data and stakeholder involvement. The public and advocacy groups often have better knowledge of what is needed in the affected community.

Once the physical system is understood, agreement terms can be written for its protection. These should include managing the water as part of a larger system, including the recharge features, tributaries, associated groundwater, and any related fragile ecosystems. In particular, for shared surface water, environmental flows provisions that create a healthy flow regime are critical. Using these holistic mechanisms, States are better positioned to respond to climatic variations and other variables that may not yet be expected.

