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## TRANSNATIONAL DESALINATION AGREEMENTS: A PANACEA FOR A PARCHED REGION OR BETTER TAKEN WITH A GRAIN OF SALT?

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## INTRODUCTION

The North American Southwest is thirsty. And even within this dry region, Arizona has a reputation for being particularly parched. Indeed, it is the only state where all four major North American deserts can be found.<sup>1</sup> Exacerbating Arizona's already arid climate, the Southwest has been gripped by a "megadrought" for the past two decades.<sup>2</sup> Studies suggest that the region may be drier now than at any other point in the last 1,200 years.<sup>3</sup> Despite this, Arizona consistently ranks as one of the fastest growing states.<sup>4</sup> In fact, Arizona's population increased an average of more than forty percent every decade since joining the Union.<sup>5</sup> This rapid population growth, coupled with ongoing drought, has placed considerable stress on the state's water supply.<sup>6</sup>

To sustain its current growth rate, Arizona must ensure that its water supply can satisfy the needs of its growing population. In recent decades, the vast majority of Arizona's development has been municipal.<sup>7</sup> Most of this growth is concentrated around Phoenix—a desert city that has been referred to as “a monument to man's arrogance.”<sup>8</sup> Although municipal growth is much less water-intensive than expanding rural, agricultural uses,<sup>9</sup> each new Phoenix resident uses about 100 gallons of water in their house per day.<sup>10</sup>

Arizonans rely on three primary sources to quench their thirst: groundwater, surface water

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<sup>1</sup> *Regional Natural History and Image Galleries*, ARIZ.-SONORA DESERT MUSEUM, <https://www.desertmuseum.org/desert/sonora.php#nadeserts> [https://perma.cc/RMG6-JQYU] (last visited Nov. 11, 2022).

<sup>2</sup> Mikala Novitsky, *Arizona Faces Megadrought, Worst Drought in 1,200 Years*, KOLD, Feb. 14, 2022, <https://www.kold.com/2022/02/15/arizona-faces-megadrought-worst-drought-1200-years/> [https://perma.cc/2BBM-9FDM].

<sup>3</sup> *Id.*

<sup>4</sup> See Valorie Rice, *Census 2020: Arizona Among Top-Growing States but Does Not Match Growth of Previous Decades*, ARIZ.'S ECON., April 27, 2021, <https://www.azeconomy.org/2021/04/demographics-census/census-2020-arizona-among-top-growing-states-but-does-not-match-growth-of-previous-decades/> [https://perma.cc/NR8B-2RBM].

<sup>5</sup> *Id.*

<sup>6</sup> See SUSANNA EDEN & SHARON B. MEDGAL, WATER AND GROWTH, IN REPORT OF THE EIGHTY-EIGHTH ARIZONA TOWN HALL 63, 63 (2006), <https://legacy-wrrc.cals.arizona.edu/sites/wrrc.arizona.edu/files/Water-and-Growth.pdf>.

<sup>7</sup> See Erik J. Toll, *Maricopa County #1; Greater Phoenix #2: Fastest U.S. Metro Growth in 2020*, CITY OF PHX. (May 10, 2021, 3:00 PM), <https://www.phoenix.gov/newsroom/ced/1887> [https://perma.cc/2ZHE-4B2D].

<sup>8</sup> *King of the Hill: The Honeymooners* (Deedle-Dee Productions, May 3, 2010).

<sup>9</sup> Areas of housing generally require less water than comparably sized areas used for farming. GRADY GAMMAGE JR. ET AL., MEGAPOLITAN: ARIZONA'S SUN CORRIDOR 46 (2008), [https://morrisoninstitute.asu.edu/sites/default/files/megapolitan\\_azsuncorr.pdf](https://morrisoninstitute.asu.edu/sites/default/files/megapolitan_azsuncorr.pdf). Because of the less intensive water needs of residential development, it is possible that reducing agriculture in Arizona can sustain long-term residential and industrial growth. See *id.* at 45–46; see also NAT'L ACAD. OF SCI., COLORADO RIVER BASIN WATER MANAGEMENT, REPORT IN BRIEF 3 (2007), [https://nap.nationalacademies.org/resource/11857/colorado\\_river\\_management\\_final.pdf](https://nap.nationalacademies.org/resource/11857/colorado_river_management_final.pdf). Of course, reducing agriculture in the state that provides over ninety percent of the United States' leafy produce each winter will have other, significant consequences. See generally Kim Chipman & Mark Chediak, *America's Winter Lettuce Hub Set to Bear Brunt of Water Cuts*, BLOOMBERG, Aug. 16, 2022, <https://www.bloomberg.com/news/articles/2022-08-16/america-s-winter-lettuce-hub-faces-withering-water-cuts> [https://perma.cc/3QVL-24LB].

<sup>10</sup> CITY OF PHX., WATER RESOURCE PLAN 60–61 (2021), <https://www.phoenix.gov/waterservicessite/Documents/2021%20City%20of%20Phoenix%20Water%20Resource%20Plan.pdf>.

(e.g., in-state rivers and streams), and Colorado River water.<sup>11</sup> Though all three sources are nominally renewable, Arizona's groundwater is being depleted faster than it can recharge,<sup>12</sup> and climate change is "dramatically" diminishing the amount of available surface water.<sup>13</sup> The Colorado River—which is also being diminished by climate change<sup>14</sup>—is governed by a series of agreements that allocate a total of 16.5 million acre-feet (MAF) of water per year between Arizona, six other American states, and Mexico.<sup>15</sup> However, this allocation was based on negotiations conducted during periods of abnormally high flow.<sup>16</sup> Modern studies suggest that average yearly flows are closer to 14.5 MAF than 16.5 MAF.<sup>17</sup> Making matters worse, states in the Colorado River's "Lower Basin"—Arizona, California, and Nevada—have not been adequately accounting for evaporation or other system losses on the River.<sup>18</sup> This has resulted in an additional structural deficit of approximately 1.2 MAF per year.<sup>19</sup> It is evident that all three of the state's primary water sources are under substantial stress.

In response to these water pressures, Arizona has taken several steps to bolster its long-term water security. The innovative Groundwater Management Act has been enacted to address aquifer mining.<sup>20</sup> Water-intensive agricultural uses have been discontinued or converted to residential use.<sup>21</sup> Effluent reclamation has been increased.<sup>22</sup> Even so, if Arizona's population continues to grow, it is unlikely that in-state solutions will be sufficient to meet the state's water demands.<sup>23</sup>

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<sup>11</sup> Arizona's water supply is roughly forty-one percent groundwater, thirty-six percent Colorado River water, and eighteen percent non-Colorado surface water. Ariz. Dep't Water Res., *Arizona's Water Supplies*, ARIZ. WATER FACTS, <https://www.arizonawaterfacts.com/water-your-facts> [<https://perma.cc/62XM-9WNV>] (last visited Nov. 7, 2022). The remaining five percent of the state's portfolio is comprised of reclaimed water. *Id.* The state's water portfolio is not necessarily representative of a municipality's. For example: Phoenix gets about forty percent of its water from the Colorado River, fifty-eight percent from the Salt and Verde Rivers (i.e., surface water), and only two percent from groundwater. Ian James, *Supercharged by Climate Change, 'Megadrought' Points to a Drier Future in the West*, ARIZ. REPUBLIC, May 6, 2020, <https://www.azcentral.com/story/news/local/arizona-environment/2020/05/06/western-megadrought-centuries-worsened-climate-change-global-warming/3036460001/> [<https://perma.cc/LFB7-T7EW>].

<sup>12</sup> See Kathleen Ferris & Sarah Porter, THE MYTH OF SAFE-YIELD: PURSUING THE GOAL OF SAFE-YIELD ISN'T SAVING OUR GROUNDWATER 45 (2021), [https://morrisoninstitute.asu.edu/sites/default/files/the\\_myth\\_of\\_safe-yield\\_0.pdf](https://morrisoninstitute.asu.edu/sites/default/files/the_myth_of_safe-yield_0.pdf).

<sup>13</sup> James, *supra* note 11; accord A. Park Williams et al., *Large Contribution from Anthropogenic Warming to an Emerging North American Megadrought*, 368 SCIENCE 314, 314–17 (2020).

<sup>14</sup> Abraham Lustgarten, *40 Million People Rely on the Colorado River. It's Drying Up Fast.*, N.Y. TIMES, Aug. 27, 2021, <https://www.nytimes.com/2021/08/27/sunday-review/colorado-river-drying-up.html> [<https://perma.cc/LZ3A-JT4J>].

<sup>15</sup> CHARLES V. STERN & PERVAZE A. SHEIKH, CONG. RSCH. SERV., R45546, MANAGEMENT OF THE COLORADO RIVER: WATER ALLOCATIONS, DROUGHT, AND THE FEDERAL ROLE 4, 6 (2022), <https://sgp.fas.org/crs/misc/R45546.pdf>.

<sup>16</sup> NAT'L ACAD. OF SCI., *supra* note 9, at 2; Buschatzke & Klobas, *infra* note 72, at 29.

<sup>17</sup> Connie A. Woodhouse et al., *Updated Streamflow Reconstructions for the Upper Colorado River Basin*, WATER RES. RESEARCH, May 2006, at 11, 12, <https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2005WR004255>.

<sup>18</sup> Anne J. Castle, *Drought Contingency Planning in the Colorado River Basin*, 66 ANN. ROCKY MT. MIN. L. INST. § 6.04 (2020).

<sup>19</sup> *Id.*

<sup>20</sup> Kristen H Engel, Esther Loiseleur & Elise Drilhon, *Arizona's Groundwater Management Act at Forty: Tackling Unfinished Business*, 10 ARIZ. J. ENV'T L & POL'Y 187, 189 (2020).

<sup>21</sup> See NAT'L ACAD. OF SCI., *supra* note 9.

<sup>22</sup> See Karl Kohlhoff & David Roberts, *Beyond the Colorado River: Is an International Water Augmentation Consortium in Arizona's Future?*, 49 ARIZ. L. REV. 257, 278 (2007).

<sup>23</sup> *Id.* at 280.

Out-of-state options must be considered to allow Arizonans to avoid a colossal case of collective cottonmouth.

South of the international border, the Mexican state of Sonora is also confronting issues with its water supply. Like Arizona, Sonora has a growing population.<sup>24</sup> Also like Arizona, Sonora has been taking steps to bolster water security—including using augmentation techniques like cloud seeding.<sup>25</sup> Despite this, tens of thousands of hectares of agricultural land are at risk of being fallowed due to drought,<sup>26</sup> and thousands of demonstrators have gathered in the capital Hermosillo to protest water insecurity.<sup>27</sup> Furthermore, much of the water infrastructure in northern Sonora is in need of repair. Inadequate investment in this infrastructure exacerbates the ongoing drought; it has been estimated that nearly half of the water north of Hermosillo is lost to leakage.<sup>28</sup> Like Arizona, Sonora has strong incentives to consider additional options to expand its water supply.

One option under consideration is a binational desalination agreement with Mexico. More specifically: desalting seawater on Mexico's coast and distributing the resultant freshwater to the people of Arizona and Sonora. This option holds promise in part because it represents the addition of an entirely “new” source of water to the region.<sup>29</sup>

Desalination may represent a new source of water, but the idea of using desalted seawater to augment the Colorado River is not new at all.<sup>30</sup> As early as 1965, environmental champion Stewart Udall identified desalination as a potential source of new Colorado River water while he was serving as the United States Secretary of the Interior.<sup>31</sup> Secretary Udall's idea never came to fruition, however, in part because of the technology at the time.<sup>32</sup> Today, desalination technology has improved substantially, but other challenges still remain.<sup>33</sup> Even so, groups on both sides of the Arizona-Sonora border are considering its use in the region.<sup>34</sup> Indeed, both states have invested

<sup>24</sup> *Sonora*, GOBIERNO DE MEX., <https://www.economia.gob.mx/datamexico/en/profile/geo/sonora-so> [https://perma.cc/Y6QF-RE3Z] (last visited Feb. 18, 2023).

<sup>25</sup> Kendal Blust, *Sonora Governor: Desalination will have to be Part of State Water Supply*, ARIZ. PUB. MEDIA, May 31, 2022, <https://news.azpm.org/p/environmentnews/2022/5/31/210563-sonora-governor-desalination-will-have-to-be-part-of-state-water-supply/> [https://perma.cc/2CKT-D4YL].

<sup>26</sup> *Video: Not Only Monterrey Experiences Water Shortages, Hermosillo Doesn't Have Water Either*, MEX. DAILY POST, June 20, 2022, <https://mexicodailypost.com/2022/06/20/video-not-only-monterrey-experiences-water-shortages-hermosillo-doesnt-have-water-either> [https://perma.cc/VD4D-6UMY].

<sup>27</sup> *See id.*

<sup>28</sup> *Id.* (“[D]ue to lack of maintenance in the network, 40 percent of the water is lost [due to leaks]; that is a sin because we need it.”) (second alteration in original).

<sup>29</sup> *See generally* Brandon Loomis, *Pipelines? Desalination? Turf Removal? Arizona Commits \$1B to Augment, Conserve Water Supplies*, ARIZ. REPUBLIC, June 27, 2022, <https://www.azcentral.com/story/news/local/arizona-environment/2022/06/27/arizona-lawmakers-bank-billion-dollars-augment-and-save-water/7736861001/> [https://perma.cc/87MW-9QEC] (listing desalination as one of the “new water projects” being promoted as part of a state water augmentation appropriation).

<sup>30</sup> Larry R. Dozier, *Colorado River Augmentation*, 37 ABA TRENDS, May/June 2006, at 1.

<sup>31</sup> *Id.*

<sup>32</sup> *See generally* Tom M. Pankratz, *Advances in Desalination Technology*, 1 INT'L J. NUCLEAR DESALINATION 450, 450 (2005) (noting that technological advances in desalination have reduced costs and improved performance and reliability).

<sup>33</sup> *See generally* Kohlhoff & Roberts, *supra* note 22, at 280–81.

<sup>34</sup> Blust, *supra* note 25; Brandon Loomis, *Pipelines? Desalination? Turf Removal? Arizona Commits \$1B to Augment, Conserve Water Supplies*, ARIZ. CENT., June 27, 2022, <https://www.azcentral.com/story/news/local/arizona-environment/2022/06/27/arizona-lawmakers-bank-billion-dollars-augment-and-save-water/7736861001/> [https://perma.cc/DG2S-DJAF].

or allocated millions to desalination projects and research,<sup>35</sup> but various obstacles have prevented a transnational agreement from being reached.

This Note addresses select environmental, legal, and practical obstacles in three parts, and concludes that that an Arizona-Sonora desalination agreement can be an integral component of both states' water portfolios. Though most groups considering a transnational agreement assume the Colorado River is the most advantageous delivery point for desalted water, it is not clear that they have adequately considered the complex legal framework that controls water once it flows into the river. This Note examines this legal framework and explains how it may be harnessed successfully. But there may be a better way. A transnational agreement based on the needs and expertise of border communities will be more resilient and may avoid some of the transaction costs associated with the Colorado River.

This Note proceeds in three parts. Part I sets the stage by giving a high-level overview of some specific challenges facing a transnational desalination agreement between the United States and Mexico. Part II addresses these challenges in three ways. First, by describing potential environmental-impact mitigation methods. Second, by exploring how Binational Intentionally Created Surplus (BICS)—a water conservation program based on United States Department of the Interior guidance—provides a sufficient mechanism for legal exchange of Colorado River water rights between Mexico and Arizona. Third, by arguing that an Arizona-Mexico desalination agreement crafted from the bottom up (that is, based on local expertise and existing cross-border relationships) may be likely to succeed because it shares relevant similarities with existing transboundary water transfers on the United States-Canada border. Finally, Part III concludes by summarizing the salient points in favor of a transnational water augmentation agreement based on local needs and expertise.

## **I. CHALLENGES FACING AN ARIZONA-MEXICO DESALINATION AGREEMENT**

A transnational effort to augment water in one of the United States' largest river basins is a massive undertaking.<sup>36</sup> While the Colorado is not the longest river in the United States, it is likely the most legislated, debated, and litigated.<sup>37</sup> It should therefore come as no surprise that many challenges must be overcome before such an effort can be realized.

This Part begins by identifying the different configurations of physical infrastructure required for a transboundary desalination agreement. It then examines specific difficulties within three broader categories of challenges, which must be addressed for these configurations to succeed. Other potential difficulties—such as the energy demands of certain desalting techniques,<sup>38</sup> the

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<sup>35</sup> Loomis, *supra* note 34; *August Tender Expected for Sonora Desalination Plant*, BNAMERICAS, March 7, 2016, <https://www.bnamericas.com/en/news/waterandwaste/august-tender-expected-for-sonora-desalination-plant> [<https://perma.cc/7QYK-CNRH>].

<sup>36</sup> *Cf.* BUREAU OF RECLAMATION, U.S. DEP'T OF THE INTERIOR, BASIN REPORT: COLORADO RIVER (2016), <https://www.usbr.gov/climate/secure/docs/2016secure/factsheet/ColoradoRiverBasinFactSheet.pdf> (noting that the Colorado River Basin is about 250,000 square miles in area and the Colorado River is approximately 1,400 miles long).

<sup>37</sup> MARC RESINER, *CADILLAC DESERT: THE AMERICAN WEST AND ITS DISAPPEARING WATER* 125 (1st ed. 1986).

<sup>38</sup> Sydney Miller, Hilla Shemer & Raphael Semiat, *Energy and Environmental Issues in Desalination*, 366 *DESALINATION* 2, 3–4 (2015).

land-use obstacles inherent in piping desalinated water from coastlines to inland reservoirs,<sup>39</sup> or the relative fiscal cost of desalination<sup>40</sup>—must also be addressed before the benefits of a transnational augmentation agreement can be realized, though they are outside the scope of this Note.<sup>41</sup>

### ***A. Potential Facility and Infrastructure Configurations***

Before discussing the challenges that a desalination agreement may face, a brief overview of the physical infrastructure is warranted. As described in this Note, a desalination agreement would require two primary physical components: (1) the desalting facility, which purifies seawater and produces freshwater; and (2) pumping stations and pipelines to transport the purified freshwater to a place where it can be used or stored.

There are two coastal regions within a reasonable distance of Arizona where a desalting facility could be located: California's Pacific coastline and Mexico's coastline with the Sea of Cortez. The latter is likely more advantageous for five reasons. First, the distance from Arizona's reservoirs to the Sea of Cortez is less than the distance to the Pacific Ocean. Second, it is difficult to find acceptable locations for desalting plants in Southern California due to its dense population and developed beaches.<sup>42</sup> Third, California is also experiencing many of the same water pressures as Arizona and holds a considerable advantage when it comes to shared water sources.<sup>43</sup> Because of this, California has no incentive to allow Arizona to develop desalting facilities on its coast in order to engage in water-trading agreements, as it is far more likely to simply develop facilities of its own.<sup>44</sup> Fourth, Mexico has a strong interest in improving the water quality and infrastructure in the region near the Sea of Cortez—something that could be achieved under a desalination agreement with Arizona.<sup>45</sup> Finally, the regulatory body controlling land on the California coast—the California Coastal Commission—has historically been unfriendly towards desalination.<sup>46</sup>

<sup>39</sup> Cf. 323 WORK GROUP REPORT TM3, *infra* note 40 at 21 (setting aside a potential desalination opportunity because of the inability to convey water inland).

<sup>40</sup> Compare BLACK & VEATCH, BINATIONAL STUDY OF WATER DESALINATION OPPORTUNITIES ON THE SEA OF CORTEZ TM3, IDENTIFICATION OF POTENTIAL DESALINATION OPPORTUNITIES 260 (2020) [hereinafter 323 WORK GROUP REPORT TM3], [https://www.ibwc.gov/Files/TMs\\_All\\_Portfolio.pdf](https://www.ibwc.gov/Files/TMs_All_Portfolio.pdf) (estimating a roughly \$2000 price per acre-foot for desalting water and delivering it to the Morelos Dam for exchange) with CENT. ARIZ. PROJECT, CENTRAL ARIZONA PROJECT FINAL 2022-2026 RATE SCHEDULE 1 (2021), <https://library.cap-az.com/documents/departments/finance/Final-CAWCD-2022-2026-Water-Rate-Schedule.pdf> (listing an approximately \$200 price per acre-foot for municipal water). Despite the expense of desalted ocean water relative to Central Arizona Project water, it is worth noting that the price of desalination is roughly equivalent to the price of other methods of augmenting Arizona's water supply. See Brandon Loomis, *Colorado River Drought May be the 'New Normal' and Living with It Will Be Costly, Leaders Say*, ARIZ. REPUBLIC, May 7, 2022, <https://www.azcentral.com/story/news/local/arizona-environment/2022/05/07/arizona-will-have-to-dig-deep-for-money-as-water-shortage-worsens/9682189002/> [<https://perma.cc/DNG4-EXVP>].

<sup>41</sup> For a discussion on some of these topics—with a focus on sustainability opportunities in desalination—see Muhammad Wakil Shahzad et al., *Energy-Water-Environment Nexus Underpinning Future Desalination Sustainability*, 413 DESALINATION 52 (2017).

<sup>42</sup> Kohlhoff & Roberts, *supra* note 22, at 282.

<sup>43</sup> See *California Drought Action*, STATE OF CAL., <https://drought.ca.gov/> [<https://perma.cc/SX7W-GC7C>] (last visited Oct. 31, 2022).

<sup>44</sup> Kohlhoff & Roberts, *supra* note 22, at 282.

<sup>45</sup> *Id.* at 282–83.

<sup>46</sup> See Rachel Becker, *A Salty Dispute: California Coastal Commission Unanimously Rejects Desalination Plant*, CAL MATTERS, May 12, 2022, <https://calmatters.org/environment/2022/05/california-desalination-plant-coastal-commission/> [<https://perma.cc/ML9L-2GQZ>]; see also Rivard, *infra* note 47.

For these reasons, it is generally accepted that Arizona should focus on locating a desalting facility on the Sea of Cortez.<sup>47</sup> It is less clear, however, where to deliver the water after desalination. This Note considers two possibilities for water delivery: (1) piping desalted water to a reservoir on the mainstem of the Colorado River;<sup>48</sup> or (2) piping desalted water to a reservoir in Arizona that is not located on the Colorado River.<sup>49</sup> These two general delivery categories are sufficiently detailed to explore the implications of different methods of apportioning water rights under a transboundary agreement. They have been selected to analyze the implications of augmenting Arizona's water supply by comparing new water being added to the mainstem of the Colorado River with adding water to reservoirs not governed by Colorado River water law.

### B. *Environmental Effects of Desalination Facilities*

No matter where desalinated water is used, constructing a desalination facility necessarily implicates numerous environmental issues. Should Arizona and Mexico wish to jointly build a facility on the Sea of Cortez, two main negative environmental impacts must be considered:<sup>50</sup> (1) desalination's carbon footprint;<sup>51</sup> and (2) the environmental degradation caused by disposing of brine—a waste product of desalination.<sup>52</sup>

Drop-for-drop, desalination facilities generally produce substantially more greenhouse gases than conventional water sources.<sup>53</sup> This is because current seawater desalination technology is more energy-intensive than traditional water supplies.<sup>54</sup> Almost forty cents out of every dollar used to desalt ocean water goes to pay the electric bill.<sup>55</sup> This intense demand for energy, coupled with the fact that the majority of existing desalting facilities consume electricity supplied by fossil-fuel-burning power stations, results in an alarming carbon footprint when desalination is compared to

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<sup>47</sup> See, e.g., Kohlhoff & Roberts, *supra* note 22, at 282 (describing an Arizona-funded desalination plant located in Mexico as “promising” and having “multiple advantages” over one located in California); Ry Rivard, *Environment Report: For Long-Term Water Supply, U.S. Officials Look to Mexico*, VOICE OF SAN DIEGO, April 8, 2019, <https://voiceofsandiego.org/2019/04/08/environment-report-for-long-term-water-supply-u-s-officials-look-to-mexico/> [<https://perma.cc/38M3-8P2F>] (reporting that Arizona water expert Chuck Cullom completely “dismissed” California as an option for a desalination facility).

<sup>48</sup> Morelos Dam, located on the Colorado River at the Arizona-Mexico border, has been identified as a promising delivery location because it offers binational benefits. 323 WORK GROUP REPORT TM3, *supra* note 40, at 20–22.

<sup>49</sup> Three possibilities are Lake Pleasant, Painted Rock Reservoir, or SAVSARP/CAVSARP. See *infra* Part II.C.

<sup>50</sup> See Miller, Shemer & Semiat, *supra* note 38, at 4 (“The main concerns of the effects of desalination on the environment include emission of air pollutants and greenhouse gases . . . and discharge of relatively high-temperature, elevated salinity and chemical-laden concentrate [brine].”).

<sup>51</sup> See Miller, Shemer & Semiat, *supra* note 38, at 3; *infra* note 50.

<sup>52</sup> See Argyris Panagopoulos, Katherine-Joanna Haralambous & Maria Loizidou, *Desalination Brine Disposal Methods and Treatment Technologies – A Review*, 693 SCI. OF THE TOTAL ENV'T 1, 3 (2019).

<sup>53</sup> See *infra* notes 46– 50 and accompanying text.

<sup>54</sup> Brian Bienkowski, *Desalination is an Expensive Energy Hog, but Improvements are on the Way*, THE WORLD, May 15, 2015, <https://theworld.org/stories/2015-05-15/desalination-expensive-energy-hog-improvements-are-way>.

<sup>55</sup> OFF. OF ENERGY EFFICIENCY & RENEWABLE ENERGY, U.S. DEP'T OF ENERGY, POWERING THE BLUE ECONOMY: EXPLORING OPPORTUNITIES FOR MARINE RENEWABLE ENERGY IN MARITIME MARKETS 86 (2019), <https://www.energy.gov/sites/prod/files/2019/03/f61/73355.pdf>.

other water supplies.<sup>56</sup> The risk of a desalination plant located on the Sea of Cortez becoming a major greenhouse gas emitter is compounded by the State of Sonora's energy portfolio.<sup>57</sup> Despite its abundance of renewable resources, Sonora—the Mexican state bordering the eastern shore of the Sea of Cortez—relies on fossil fuels for over ninety percent of its power generation.<sup>58</sup>

In addition to the potential carbon footprint, the biological impact of disposing of brine would also have to be adequately addressed. Brine is water that contains a high concentration of salt.<sup>59</sup> Also known as concentrate, desalting plants discharge brine as a byproduct of extracting fresh water.<sup>60</sup> Brine discharge is “the most universal environmental concern associated with seawater desalination.”<sup>61</sup>

Though most marine environments can safely absorb some amount of brine discharge, minor increases in salinity have been found to disrupt the osmotic balance of marine fauna and negatively alter the physiology of coral.<sup>62</sup> If disposed of improperly, brine can even settle at the bottom of coastal areas, suffocating animals living on the seafloor.<sup>63</sup> Complicating this issue, best practices for brine discharge may vary based on a discharge site's specific characteristics.<sup>64</sup> Although the impact of both brine discharge and greenhouse gas emissions can certainly be mitigated with proper planning, Arizona and Sonora must address both of these issues before proceeding with any transnational desalination agreement.

### C. *Transnational Water Transfers and the Law of the River*

If Arizona and Sonora can address environmental concerns involved with building a desalination facility on the Sea of Cortez, they still must also enter into a legal agreement governing rights to the water produced by the facility. This may prove more difficult than mitigating any environmental impacts because of the complex legal framework governing the Colorado River.<sup>65</sup> As with the environmental issues associated with desalination, identifying every legal issue implicated by a transboundary water transfer is well beyond the scope of this Note. Instead, this Part: (1) observes that Arizona and Mexico cannot legally enter into a transboundary water agreement without Congressional approval; (2) offers a high-level overview of the law governing the Colorado River as it pertains to potential methods of delivering desalinated water in

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<sup>56</sup> See Miller, Shemer & Semiat, *supra* note 38, at 3 (“At present, fossil fuel is the main energy source for water desalination . . . [I]t seems that this source of energy will remain the major supply for the next decades.”).

<sup>57</sup> See generally COPENHAGEN CTR. FOR ENERGY EFFICIENCY, ENERGY EFFICIENCY IN BUILDINGS: SONORA STATE, MEXICO 1 (2019), <https://c2e2.unepccc.org/wp-content/uploads/sites/3/2019/08/2019-08-bea-assessment-sonora.pdf> (illustrating Sonora's energy consumption mix).

<sup>58</sup> *Id.*

<sup>59</sup> BLACK & VEATCH, BINATIONAL STUDY OF WATER DESALINATION OPPORTUNITIES ON THE SEA OF CORTEZ TM2: DESALINATION TECHNOLOGIES AND BRINE MANAGEMENT OPTIONS 1 (2020) [hereinafter 323 WORK GROUP REPORT TM2], [https://www.ibwc.gov/Files/TMs\\_All\\_Portfolio.pdf](https://www.ibwc.gov/Files/TMs_All_Portfolio.pdf).

<sup>60</sup> *Id.*

<sup>61</sup> Miller, Shemer & Semiat, *supra* note 38, at 5.

<sup>62</sup> Panagopoulos, Haralambous & Loizidou, *supra* note 52, at 3.

<sup>63</sup> Erica Gies, *Slaking the World's Thirst with Seawater Dumps Toxic Brine in Oceans*, SCI. AM. (Feb. 7, 2019), <https://www.scientificamerican.com/article/slaking-the-worlds-thirst-with-seawater-dumps-toxic-brine-in-oceans/> [https://perma.cc/G4QT-LZ7L].

<sup>64</sup> See generally Panagopoulos, Haralambous & Loizidou, *supra* note 52, at 4 (discussing the impact of currents, ambient seawater temperature, and substrates on brine toxicity).

<sup>65</sup> See *infra* Part I.C.3.

the Colorado River basin; and (3) discusses some of the challenges a transboundary augmentation program on the mainstem of the Colorado River may face.

## 1. Binational Cooperation and Transboundary Waters

As a threshold matter, states do not have the authority to enter into compacts or agreements with foreign powers.<sup>66</sup> Thus, Arizona cannot enter into a desalination and transfer agreement with Mexico unless Congress approves.<sup>67</sup> Because of this, political sabotage or partisan gridlock could prevent an agreement from being finalized.

Congress has, however, already approved an agreement between the United States and Mexico that governs the countries' transboundary waters.<sup>68</sup> This treaty—the Treaty between the United States of America and Mexico Relating to the Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande—is generally referred to as the “1944 Water Treaty.”<sup>69</sup> It is administered by the International Boundary Water Commission (IBWC), which has the ability to supplement the treaty by issuing additional implementing agreements in the form of “minutes.”<sup>70</sup> Among other things, the 1944 Water Treaty allocates 1.5 MAF of Colorado River water to Mexico per year.<sup>71</sup>

## 2. The Law of the River

The 1944 Water Treaty is not the only instrument governing the use of the Colorado River.<sup>72</sup> Far from it. In addition to the treaty, a series of compacts, laws, court decisions, and other legal documents control Colorado River water.<sup>73</sup> Collectively, these standards are known as the “Law of the River.”<sup>74</sup> Once any water enters the Colorado mainstem, the Law of the River controls who is entitled to benefit from the water's use—and whether it can be used at all.

An early twentieth century interstate compact is one of the foundations of the Law of the River.<sup>75</sup> In 1922, six of the seven states that share the Colorado River ratified a compact allocating 7.5 MAF a year to the “Upper Basin” (Colorado, Utah, Wyoming, New Mexico, and a small portion of Arizona) and 7.5 MAF a year to the “Lower Basin” (California, Nevada, and most of

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<sup>66</sup> U.S. CONST. art. I, § 10, cl. 3.

<sup>67</sup> *See id.*

<sup>68</sup> Treaty between the United States of America and Mexico Respecting Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, U.S.-Mex., Feb. 3, 1944, 59 Stat. 1219 [hereinafter 1944 Water Treaty].

<sup>69</sup> *Id.*

<sup>70</sup> Allie Alexis Umoff, *An Analysis of the 1944 U.S.-Mexico Water Treaty: Its Past, Present, and Future*, 32 ENVIRONS ENVTL. L. & POL'Y J. 69, 77 (2008); 1944 Water Treaty, *supra* note 68, art. 25.

<sup>71</sup> 1944 Water Treaty, *supra* note 68, art. 10.

<sup>72</sup> Thomas Buschatzke & Nicole D. Klobas, *Ensuring Arizona's Future Today: The Lower Basin Drought Contingency Plan and its Implementation in Arizona*, 8 ARIZ. J. ENVTL. L. & POL'Y 29, 31 (2018).

<sup>73</sup> *Id.*

<sup>74</sup> *Id.*

<sup>75</sup> *Id.*

Arizona).<sup>76</sup> The seventh basin state—Arizona—was concerned that California would attempt to claim all of the water allocated to the Lower Basin, and refused to ratify the compact.<sup>77</sup> To overcome this gridlock, Congress enacted the Boulder Canyon Project Act (BCPA).<sup>78</sup> The act implemented the compact's 7.5 MAF allocations, approved the construction of Hoover Dam and Lake Mead, and appointed the Secretary of the Interior “water master” of the Lower Basin.<sup>79</sup> As water master, the Secretary of the Interior was authorized to contract for water storage and delivery with the Lower Basin states.<sup>80</sup>

The State of Arizona entered a water delivery contract with the Secretary of the Interior for 2.8 MAF pursuant to the BCPA,<sup>81</sup> but was still distrustful of California's potentially competing claims to water in the Lower Basin—including Arizona surface water that drained into the Colorado River.<sup>82</sup> In the 1960s, this distrust ultimately resulted in a lawsuit in the United States Supreme Court: *Arizona v. California*.<sup>83</sup> Over California's protests, the Supreme Court held that Arizona's surface water outside of the mainstream of the Colorado did not count towards Arizona's 2.8 MAF allocation.<sup>84</sup> The Court also vested more power in the Secretary of the Interior.<sup>85</sup> As water master, the Secretary of the Interior was given the authority to reapportion water rights using any “reasonable methods” during times of shortage (i.e., when less than 7.5 MAF is available for the Lower Basin).<sup>86</sup>

Under the Court's decree, Arizona was entitled to 2.8 MAF of Colorado River water a year. Even so, Arizona could not use this water in its most populous areas without first transporting it from the mainstream of the Colorado River, on the far western border, to the center of the state. To fund this major project, Arizona looked to the federal government for assistance.<sup>87</sup>

Federal legislation to construct a water-transport project was initially blocked by California's legislative delegation.<sup>88</sup> After extensive negotiation, however, a compromise was reached and Congress authorized construction of the Central Arizona Project (CAP):<sup>89</sup> a 336-mile system capable of delivering a total of 1.5 MAF of Colorado River water to Arizona's population centers.<sup>90</sup>

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<sup>76</sup> *Id.* at 31–32.

<sup>77</sup> *Id.* at 32.

<sup>78</sup> *Id.*

<sup>79</sup> *Id.*; James H. Davenport, *Softening the Divides: The Seven Colorado River Basin States' Recommendation to the Secretary of the Interior Regarding Lower Basin Shortage Guidelines and the Operation of Lakes Mead and Powell in Low Reservoir Conditions*, 10 U. DENVER WATER L. REV. 287, 289 (2007).

<sup>80</sup> Buschatzke & Klobas, *supra* note 72, at 32.

<sup>81</sup> *Id.* at 33 (citing 1944 Contract, § 7(a)).

<sup>82</sup> See generally Joe Gelt, *Sharing Colorado River Water: History, Public Policy, and the Colorado River Compact*, ARROYO, Aug. 1997, at 3–4, [https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/attachment/arroyo\\_1997\\_v10\\_n1\\_w.pdf](https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/attachment/arroyo_1997_v10_n1_w.pdf).

<sup>83</sup> 373 U.S. 546 (1963).

<sup>84</sup> *Id.* at 568–75.

<sup>85</sup> See *id.* at 592–94.

<sup>86</sup> *Id.* at 593. The Supreme Court subsequently released a decree identifying present-perfected and federal rights on the Colorado mainstem. *Arizona v. California*, 376 U.S. 340 (1963). This decree was updated with additional guidance for the Secretary of State and additional defined water rights in 2006. *Arizona v. California*, 547 U.S. 150 (2006).

<sup>87</sup> Buschatzke & Klobas, *supra* note 72, at 34.

<sup>88</sup> Michael W. Hanemann, *The Central Arizona Project 1* (Univ. Cal. Berkeley: Dep't of Agric. & Res. Econ. & Pol'y, Working Paper No. 937, 2002).

<sup>89</sup> See Colorado River Basin Project Act, of 1968, Pub. L. No. 90-537 (codified as amended in 43 U.S.C. § 1501).

<sup>90</sup> *History of CAP*, CENTRAL ARIZ. PROJECT, <https://www.cap-az.com/about/history-of-cap/> [<https://perma.cc/93DX-QZJR>] (last visited Nov. 2, 2022).

Though the authorization of the CAP was critical for Arizona's development, it came at a considerable cost. To secure federal support for the CAP, Arizona was forced to subordinate its Colorado River water rights to the State of California.<sup>91</sup> That is, in the event of a shortage, California must receive their full allocation—4.4 MAF a year—before Arizona can divert any Colorado River water down the CAP.<sup>92</sup>

Unfortunately, this meandering body of law is predicated on the erroneous assumption that, on average, 16.5 MAF of water will be available every year.<sup>93</sup> In an attempt to address this overallocation and the Southwest's ongoing drought, the Secretary of the Interior adopted additional Lower Basin guidelines in 2007 (the 2007 Guidelines).<sup>94</sup> Jointly proposed by the seven basin states to inject some flexibility into the Law of the River, the 2007 Guidelines introduced several conservation mechanisms. One of these mechanisms, Intentionally Created Surplus (ICS) allows conserved or augmented water to be "stored" in reservoirs on the Colorado River and released at a later date.<sup>95</sup>

To qualify as ICS under the 2007 Guidelines, a project must improve water system efficiency, result in "extraordinary conservation," or otherwise augment the mainstream of the Colorado River.<sup>96</sup> Examples of ICS-qualified projects include canal lining programs, importing non-Colorado River System water into the mainstream, or desalination programs wherein desalted water is used in place of mainstem water.<sup>97</sup> Once a project has been identified, it must be submitted to the Secretary of the Interior for approval.<sup>98</sup> After a project has been approved, the amount of water conserved or added by the project over the course of a year is held in reserve in a Colorado River reservoir.<sup>99</sup> The following year, an equivalent amount of water (minus system losses) may be released to the creator of the ICS if two conditions are met: (1) the Secretary of the Interior has not recognized a shortage in the Lower Basin; and (2) parties granted the right to surplus water under the Law of the River agree to forbear from exercising those rights.<sup>100</sup>

The concept of ICS was extended to Colorado River users in Mexico under Minutes 319 and 323 to the 1944 Waters Treaty.<sup>101</sup> These minutes established a framework wherein a party contracting with the Secretary of the Interior for Colorado River water may contribute capital to a

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<sup>91</sup> Buschatzke & Klobas, *supra* note 72, at 34.

<sup>92</sup> 43 U.S.C. § 1521(b).

<sup>93</sup> See *supra* notes 15–18 and accompanying text.

<sup>94</sup> Buschatzke & Klobas, *supra* note 72, at 34–37.

<sup>95</sup> *Id.* at 37–38.

<sup>96</sup> See Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead, 73 Fed. Reg. 19873, 19883 (April 11, 2008) [hereinafter 2007 Guidelines].

<sup>97</sup> *Id.* at 19886.

<sup>98</sup> *Id.* at 19887.

<sup>99</sup> See Buschatzke & Klobas, *supra* note 72, at 37.

<sup>100</sup> See 2007 Guidelines, *supra* note 90, at 19882–83; Buschatzke & Klobas, *supra* note 72, at 38.

<sup>101</sup> Int'l Boundary & Water Comm'n, *Minute No. 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* (Nov. 20, 2012), [https://www.ibwc.gov/Files/Minutes/Minute\\_319.pdf](https://www.ibwc.gov/Files/Minutes/Minute_319.pdf) [hereinafter Minute 319]; Int'l Boundary & Water Comm'n, *Minute No. 323: Extension of Cooperative Measures and Adoption of a Binational Water Scarcity Contingency Plan in the Colorado River Basin* (Sept. 21, 2017), <https://www.ibwc.gov/Files/Minutes/Min323.pdf> [hereinafter Minute 323].

binational augmentation project in Mexico and receive a corresponding ICS allocation.<sup>102</sup> Surplus created in this manner is known as Binational ICS (BICS), and is eligible for release under similar conditions as ICS created under the 2007 Guidelines, including the requirements that: (1) the Lower Basin is not experiencing a shortage; and (2) the necessary parties enter a forbearance agreement regarding the surplus water created by the BICS.<sup>103</sup>

### 3. Risks of Relying on Binational Intentionally Create Surplus

At first blush, the BCIS framework created by Minutes 319 and 323 seems tailor-made for an Arizona-Mexico desalination agreement. Indeed, Minute 323 specifically identifies a binational desalination plant on the Sea of Cortez as a promising project.<sup>104</sup> Despite this, there are both legal and political obstacles that must be surmounted before breaking ground on such a project. One of these challenges is that, once water has been added to the Colorado River, the Law of the River governs when and whether the water can be used.

Under the Law of the River, stored BICS water may not be released when the Lower Basin is experiencing a shortage.<sup>105</sup> That is, when the Lower Basin is expected to receive less than its 7.5 MAF allocation.<sup>106</sup> This poses a potentially serious obstacle to harnessing BICS for a transboundary desalination agreement. A major motivating factor behind developing a binational augmentation agreement is that the Colorado River is overallocated and the Southwest is experiencing a severe drought.<sup>107</sup> Because of these stressors, it is quite possible the Lower Basin may not receive its entire 7.5 MAF allotment at some point in the near future. Ironically, water shortages—the very problem a transnational desalination agreement seeks to remedy—could prevent the legal release of BICS water stored under such an agreement.

Political friction may also pose an obstacle to a successful BICS-based agreement. In order to harness the BICS program to transfer Colorado River water rights from Mexico to Arizona, forbearance agreements must first be obtained from the Southern Nevada Water Authority, the Colorado River Commission of Nevada, the Palo Verde Irrigation District, the Imperial Irrigation District, the Coachella Valley Water District, The Metropolitan Water District of Southern California, and the City of Needles.<sup>108</sup> Given the contentious history of parties on the Colorado River, it is entirely possible the requisite parties will withhold approval.<sup>109</sup> In addition to

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<sup>102</sup> This is a multi-step framework. First, water is conserved or “created” in Mexico, allowing delivery of Colorado River water to be deferred and remain in mainstream reservoirs in the United States. Minute 319, *supra* note 101, at § III. Next, waters conserved, created, or otherwise not delivered to Mexico—Mexico’s Water Reserves—are converted to Binational ICS by the United States Bureau of Reclamation in consultation with the Lower Basin States. *See* Interim Operating Agreement for Implementation of Minute No. 323 § 7.3 (Sept. 21, 2017), <https://library.cap-az.com/documents/meetings/2017-08-03/1639-7.%20web%20Minute%20323.pdf>. Finally, once converted to Binational ICS, the waters are subject to minor deductions for system losses and efficiency. *See id.*

<sup>103</sup> Interim Operating Agreement for Implementation of Minute No. 23, *supra* note 102, at §§ 7.1, 7.4.

<sup>104</sup> Minute 323, *supra* note 101, at § IV.B.

<sup>105</sup> Interim Operating Agreement for Implementation of Minute No. 23, *supra* note 102, at § 7.4.4.

<sup>106</sup> *See supra* note 86 and accompanying text.

<sup>107</sup> *See supra* notes 15–18 and accompanying text.

<sup>108</sup> *See generally* 2007 Guidelines *supra*, note 96 at 19883 (listing the requisite forbearing parties for ICS, which have been incorporated into BICS).

<sup>109</sup> *See supra* Part I.B.2 (describing a small portion of the historic rivalry between Arizona and California over the Colorado River); *see also* *Arizona v. California*, 373 U.S. 546, 552 (1963) (noting “the continued failure of the States to agree on how to conserve and divide the waters” of the Colorado River).

forbearance agreements, achieving a transboundary desalination agreement will require a new binational treaty—in the form of a minute to the 1944 Waters Treaty.<sup>110</sup> The implementation of a new minute is also subject to risk of disapproval and, at the very least, it is likely to add further transaction costs to an already expensive agreement.

Finally, using BICS to “free up” Colorado River water rights for municipal use in Central Arizona allocates the risk of upstream shortages to municipal users. This is because, under the BICS program, Colorado River water allocated to Mexico must be reserved and stored on the Colorado mainstem.<sup>111</sup> Then, after the Secretary of the Interior determines the water is eligible for release, the water will be diverted off of the mainstem of the Colorado River into the CAP.<sup>112</sup> This diversion occurs at Lake Havasu, located on Arizona’s border with California, over 100 miles north of the Arizona-Mexico border.<sup>113</sup> However, the delivery point of a desalination agreement between Arizona and Sonora is likely to be located much closer to the Sea of Cortez—the Morelos Dam has been suggested as a promising location.<sup>114</sup> This means that CAP users bear the risk of upstream shortages, because the CAP diversion point is upstream of the likely desalination delivery point.

These hurdles are not insurmountable. Even so, their existence suggests that a desalination agreement that proposes to augment the Colorado River will face considerable legal, political, and practical problems.

#### ***D. American-Canadian Transboundary Water Sharing Agreements***

As discussed in Part I.B, an Arizona-Mexico desalination agreement may be able to rely on BICS to reallocate rights to Colorado River waters. Even so, there are nontrivial transaction costs to implementing such an agreement, and potential risks to Arizona once implemented. As an alternative, Arizona and Sonora may wish to model a transboundary desalination agreement on inter-local water sharing agreements spanning the United States-Canada border, instead of relying on the law governing the “most litigated river in the entire world.”<sup>115</sup>

Much like water on the Colorado River, Canadian water exports have been the source of many disputes and much controversy,<sup>116</sup> but several inter-local water agreements between Canada and the United States have nevertheless been established.<sup>117</sup> Although most of these agreements

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<sup>110</sup> See 323 WORK GROUP REPORT TM3, *supra* note 40, at 124.

<sup>111</sup> See *supra* Part I.C.2.

<sup>112</sup> See *supra* Part I.C.2.

<sup>113</sup> See Central Ariz. Project, *About*, <https://www.cap-az.com/about/> [<https://perma.cc/H8SY-G7AZ>] (last visited Nov. 29, 2022).

<sup>114</sup> See 323 WORK GROUP REPORT TM3, *supra* note 40, at 20–22.

<sup>115</sup> RESINER, *supra* note 37, at 125.

<sup>116</sup> See, e.g., Barrie McKenna, *It’s Time Canada Reassessed Its Stance on Selling Water*, GLOBE & MAIL, Sept. 20, 2015, <https://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/its-time-canada-reassessed-its-stance-on-selling-water/article26448144/> [<https://perma.cc/VZN2-BDRZ>]; Cynthia Baumann, *Water Wars: Canada’s Upstream Battle to Ban Bulk Water Export*, 10 MINN. J. GLOBAL TRADE 109, 109 (2001).

<sup>117</sup> Patrick Forest, *Transferring Bulk Water Between Canada and the United States: More than a Century of Transboundary Inter-Local Water Supplies*, 43 GEOFORUM 14, 16 (2012).

transfer relatively small volumes of water, and none of them transfer more than 100,000 acre-feet a year, they are still positive drivers of international water cooperation.<sup>118</sup>

Aside from their limited size, these agreements share several relevant similarities. As a threshold matter, the water agreements “emerged out of a bottom-up process based on [the] local knowledge and understanding” of neighboring communities located near international borders.<sup>119</sup> That is, the entities directly involved in transferring the water were responsible for negotiating and establishing the agreements, as opposed to a central authority.<sup>120</sup> Because of this, the actual governance structure of these agreements is generally unique. Though unique, these agreements are all driven by two primary factors: (1) the economics of water infrastructure; and (2) water scarcity.<sup>121</sup>

Arizona and Sonora may share some relevant similarities with these inter-local water sharing agreements. Specifically, both states suffer from water scarcity and a joint partnership between the two states creates economic value.<sup>122</sup> Even so, the ideal volume of a binational desalination agreement is larger than most of the existing United States-Canada agreements,<sup>123</sup> and the distance between Arizona’s primary population centers and the Sea of Cortez is much farther than the distance between any of the communities with transboundary water sharing agreements on the Northern U.S. border.<sup>124</sup> Additionally, a bilateral agreement between Arizona and Sonora would still need to be ratified by Congress.<sup>125</sup> Given the contentious nature of southwestern water disputes—and politics generally—other states might conspire to withhold the requisite federal approval for an Arizona-Mexico agreement.<sup>126</sup>

## II. OVERCOMING THE CHALLENGES FACING AN ARIZONA-MEXICO DESALINATION AGREEMENT

It may seem as if an agreement to augment the southwest’s water supply using desalinated water from the Sea of Cortez faces too many challenges to succeed. Though the challenges described in Part I are not negligible (nor exhaustive) there are several ways they can be overcome. This Part outlines potential solutions to the problems described in Part I. First, plans to mitigate environmental harm are identified. Second, the legal and political merits of potential agreement structures are analyzed with a focus on addressing the issues identified in Part I. The agreement structures analyzed can be broadly separated into two categories: (1) transferring Colorado River allocations by harnessing the Law of the River (i.e., a “top-down” agreement using existing legal

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<sup>118</sup> *Id.*

<sup>119</sup> *Id.*

<sup>120</sup> *Id.*

<sup>121</sup> *Id.* at 17.

<sup>122</sup> That is, Sonora possesses the requisite shoreline and Arizona can help defray the financial cost of desalination and delivery infrastructure.

<sup>123</sup> The binational Minute 323 work group identified a range of 50,000 to 200,000 acre-feet a year as optimal and feasible. See 323 WORK GROUP REPORT TM2, *supra* note 59, at 5, 7.

<sup>124</sup> See Forest, *supra* note 117, at 16, 16 n.6 (finding that Canadian and American communities with successful transboundary water agreements were located within ten kilometers of the international border).

<sup>125</sup> See *supra* notes 66–67 and accompanying text.

<sup>126</sup> See Robert Glennon, *Interstate Water Wars Are Heating Up Along with the Climate*, THE CONVERSATION, April 19, 2021, <https://theconversation.com/interstate-water-wars-are-heating-up-along-with-the-climate-159092> [<https://perma.cc/FPK4-5S5H>] (describing several interstate water disputes and arguing that climate stresses are exacerbating disputes of this nature).

frameworks created by a central authority); and (2) conveying desalted water directly to reservoirs in Arizona (i.e., a “bottom-up” agreement based on local water cooperation and shared need).

***A. Planning and Placement Can Negate Many of the Harmful Environmental Impacts of Desalination***

The two most pressing environmental consequences of desalination are its carbon footprint and brine disposal requirements.<sup>127</sup> Fortunately, advances in clean energy and brine treatment can help mitigate these potential problems.<sup>128</sup> When combined with proper planning and placement, these advances can minimize the environmental impacts of desalination—if not eliminate them entirely.

Desalination facilities often benefit from co-location with power plants.<sup>129</sup> To minimize its carbon footprint, a desalination plant may be co-located with solar generation facilities. This is an especially promising alternative to relying on Sonora’s existing carbon-intensive energy portfolio because the Sea of Cortez coastline has exceptional, untapped solar resources and photovoltaic solar generation technology has reached price parity with conventional electricity generation.<sup>130</sup> Additionally, tidal and wave hydroelectric generation technology has been successfully paired with desalination—albeit on a relatively small scale.<sup>131</sup> Continued advances in utility-scale ocean hydroelectric power suggest that large-scale hydro-powered desalination will be achieved in the near future.<sup>132</sup>

Advances in technology can also minimize the impact of brine disposal. Diffused offshore outfall—a method wherein brine is conveyed through a long pipeline and diluted with seawater before being dispersed offshore—has been identified by at least one binational working group as a viable brine management option on the Sea of Cortez.<sup>133</sup> Furthermore, recent innovations in on-

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<sup>127</sup> See *supra* Part I.B.

<sup>128</sup> See Jochen Bundschuh et al., *State-of-the-Art of Renewable Energy Sources Used in Water Desalination: Present and Future Prospects*, 508 DESALINATION 1, 18, 20–21 (2021); Youngkwon Choi et al., *Membrane Distillation Crystallization for Brine Mining and Zero Liquid Discharge: Opportunities, Challenges, and Recent Progress*, 5 ENV’T SCI.: WATER RES. TECH. 1202, 1202–03 (2019).

<sup>129</sup> See generally 323 WORK GROUP REPORT TM2, *supra* note 59, at 54 (listing benefits of co-location).

<sup>130</sup> Manajit Sengupta et al., *The National Solar Radiation Data Base (NSRDB)*, 89 RENEWABLE & SUSTAINABLE ENERGY REV. 51, 53 (2018); Bundschuh et al., *supra* note 128, at 20; see also *supra* notes 49–50 and accompanying text.

<sup>131</sup> See Office of Energy Efficiency & Renewable Energy, *DOE Announces Winners of Wave Energy-Powered Desalination Prize Competition*, ENERGY.GOV (April 8, 2022), <https://www.energy.gov/eere/articles/doe-announces-winners-wave-energy-powered-desalination-prize-competition> [<https://perma.cc/4S92-X8ZB>]; Anmar Frangoul, *A Wave-Powered Prototype Device Is Aiming to Produce Drinking Water from the Ocean*, CNBC (Nov. 24, 2022), <https://www.cnbc.com/2022/11/24/a-wave-powered-prototype-device-is-aiming-to-produce-drinking-water-from-the-ocean.html> [<https://perma.cc/U2CA-PYZU>].

<sup>132</sup> Cf. OCEAN ENERGY EUROPE, *OCEAN ENERGY: KEY TRENDS AND STATISTICS 2021 6–10, 28–29* (Amy Parsons & Remi Gruet eds. 2022), [https://www.oceanenergy-europe.eu/wp-content/uploads/2022/03/OEE\\_Stats\\_and\\_Trends\\_2021\\_web.pdf](https://www.oceanenergy-europe.eu/wp-content/uploads/2022/03/OEE_Stats_and_Trends_2021_web.pdf) (discussing the rapid growth of existing ocean hydroelectric power, describing the multi-billion dollar investment in ocean hydroelectric technology in 2021, and projecting increased deployment of “full-scale” devices in the future).

<sup>133</sup> 323 WORK GROUP REPORT TM2, *supra* note 59, at 57, 62.

site brine treatment may even turn brine into a useful resource.<sup>134</sup> New processes to recover valuable chemical compounds and additional fresh water from brine have been developed and tested on the lab-scale.<sup>135</sup> Similar to tidal and wave hydropower, these processes must be scaled up before being put to use at a utility-scale desalination plant—but once they have been, “near zero” brine discharge desalination is a very real possibility.<sup>136</sup>

Though the environmental impact of a desalting facility must be considered before Arizona and Sonora finalize a transboundary water augmentation agreement, the impacts can be addressed. Co-locating a photovoltaic solar farm with a desalination plant significantly decreases the carbon footprint of a desalination plant and disposing of brine with a diffused offshore outfall mitigates the environmental impact of brine disposal.<sup>137</sup> Additional technological advances in hydroelectric power generation and brine treatment promise further mitigation of both concerns after emerging technologies have been brought up to scale.<sup>138</sup> Accordingly, two of the primary environmental issues likely to face an Arizona-Mexico desalination agreement can be overcome with appropriate planning.

### **B. “Top-Down” Agreement; Harnessing the Law of the River**

One potential way to structure a transboundary augmentation agreement is to rely on BICS and the Law of the River to transfer water rights. A BICS-based agreement offers both benefits and drawbacks to an Arizona-Mexico desalination agreement. This Part explores the relative merits of such an agreement.

To qualify for BICS credit, desalinated water must be used to conserve Colorado River water that would otherwise be consumed.<sup>139</sup> One way to achieve this requirement is to pump desalinated water directly to a reservoir on the mainstem of the Colorado River. That is, augmenting the Colorado River by pumping physical water into it. Morelos Dam—located on the mainstem of the Colorado River at the Arizona-Mexico border—has been recommended as a potential delivery point for desalinated water by the Minute 323 Working Group because it is relatively close to the Sea of Cortez, will result in increased water security for cities in the Lower Basin, and will generate mutual benefits to Mexico and the United States.<sup>140</sup> Because it has been identified as a promising delivery point, this Part examines the potential merits of augmenting the Colorado River mainstem under the assumption that desalted water will be piped to the Arizona-Mexico border and delivered at the Morelos Dam.

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<sup>134</sup> David L. Chandler, *Turning Desalination Waste into a Useful Resource*, MIT NEWS, Feb. 13, 2019, <https://energy.mit.edu/news/turning-desalination-waste-into-a-useful-resource/> [<https://perma.cc/CDR2-6LEP>]; see also Panagopoulos, Haralambous & Loizidou, *supra* note 52.

<sup>135</sup> See Chandler, *supra* note 134; Choi et al., *supra* note 128, at 1217.

<sup>136</sup> Choi et al., *supra* note 128, at 1217.

<sup>137</sup> See *supra* notes 130, 133 and accompanying text.

<sup>138</sup> See *supra* notes 131, 132, 134, 136 and accompanying text.

<sup>139</sup> See *supra* notes 96, 102 and accompanying text.

<sup>140</sup> 323 WORK GROUP REPORT TM3, *supra* note 40, at 123–24.

## 1. Merits of Augmenting the Colorado River

The most obvious Arizonan benefit of augmenting the Colorado River is increasing water availability for Arizona's growing urban centers by pulling Colorado River water down the CAP.<sup>141</sup> Another obvious benefit is increased water security for Mexican users of Colorado River water.<sup>142</sup> Without these benefits, the considerable effort and expense of a transboundary water agreement would never even be considered.

There are less obvious benefits to augmenting the Colorado River, however. One of these is environmental restoration. Due to over-appropriation, the Colorado River has not flowed regularly to the sea in over fifty years.<sup>143</sup> This has deprived the river delta of water needed to sustain native flora and fauna.<sup>144</sup> Though a transboundary desalination agreement is unlikely to create enough new water to restore a permanent flow,<sup>145</sup> intermittent flows can still provide considerable environmental benefits.<sup>146</sup> In fact, Minute 319 to the 1944 Waters Treaty authorized a temporary "pulse flow" in 2014 to help repair riparian habitat along the Colorado River delta.<sup>147</sup> A transboundary water augmentation agreement between Arizona and Mexico may help create an opportunity for another pulse flow that can help further restore this imperiled habitat.

Even if augmented water is not set aside for environmental purposes, delivering desalinated water to Morelos Dam will still improve downstream water quality.<sup>148</sup> The Colorado River south of the Morelos Dam has had a salinity problem for decades.<sup>149</sup> The problem was so pronounced during the 1960s that Mexico's allocation of Colorado River water was unfit for human, livestock, or agricultural uses.<sup>150</sup> Though its salinity has since been reduced,<sup>151</sup> recent measurements of dissolved solids in Colorado River water at the Arizona-Sonora border still show elevated

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<sup>141</sup> Specifically, the Phoenix and Tucson metro areas, via the CAP. *See generally supra* note 82 and accompanying text.

<sup>142</sup> 323 WORK GROUP REPORT TM3, *supra* note 40, at 20–21.

<sup>143</sup> Env't Defense Fund, *Bringing the River Back to the Sea*, EDF, <https://www.edf.org/sites/default/files/pulseflow/index.html> [<https://perma.cc/Z9W6-GH2Q>] (last visited Nov. 20, 2022).

<sup>144</sup> *Id.*

<sup>145</sup> 200,000 acre-feet is an estimated maximum amount of water that can be desalinated and delivered to the Colorado River by one project. *See supra* note 115. Historically, over 12 MAF flowed into the delta each year. Luke Runyon, *Five Years Later, Effects of Colorado River Pulse Flow Still Linger*, KPBS, April 10, 2019, <https://www.kpbs.org/news/midday-edition/2019/04/10/five-years-later-effects-colorado-river-pulse-flow> [<https://perma.cc/CLH3-R25E>].

<sup>146</sup> Env't Defense Fund, *supra* note 143.

<sup>147</sup> *Id.* The Pulse Flow of 2014 was approximately 105,000 acre-feet of water; it is estimated the flow sustained over 275,000 new trees, among other environmental benefits. Runyon, *supra* note 145. Minute 323 further authorized temporary flows in the Colorado River delta. Jennifer Pitt, *Water for the Colorado River Delta in a Dry Year*, AUDUBON (May 18, 2022), <https://www.audubon.org/news/water-colorado-river-delta-dry-year> [<https://perma.cc/3CYD-LXKN>]. Though these delta flows are only about one-third the volume of the 2014 Pulse Flow, they nevertheless help sustain restored riparian habitat. *Id.*

<sup>148</sup> 323 WORK GROUP REPORT TM3, *supra* note 40, at 38.

<sup>149</sup> S.E. Reynolds, *The Water Quality Problem on the Colorado River*, 12 NAT. RESOURCES J. 480, 480 (1972).

<sup>150</sup> NICOLE T. CARTER, STEPHEN P. MULLIGAN & CHARLES V. STERN, CONG. RSCH. SERV., R45430, SHARING THE COLORADO RIVER AND THE RIO GRANDE: COOPERATION AND CONFLICT WITH MEXICO 10 (2018).

<sup>151</sup> *Id.*

salinity.<sup>152</sup> An influx of freshwater from a desalination plant will further reduce the river's total dissolved solids and improve water quality.<sup>153</sup>

A further crucial advantage of adding a new source of water to the Lower Basin is that reservoirs like Lakes Powell and Mead can retain more water. This is important because these reservoirs rely on water pressure, called hydraulic head, to spin turbines and generate electricity.<sup>154</sup> More water in these reservoirs results in greater hydraulic head, which in turn generates more electricity.<sup>155</sup> Drought and climate change have shrunk Lakes Powell and Mead to levels dangerously close to minimum power pool—the point at which the reservoirs do not have enough remaining water to generate electricity.<sup>156</sup> Even more ominous, if new sources of water are not identified and reservoir levels keep dropping, Lakes Powell and Mead may hit “dead pool.”<sup>157</sup> If this occurs, downstream releases become impossible and the remaining water in the lakes will be trapped.<sup>158</sup>

Yet another strength of augmenting the Colorado River, as opposed to conveying water directly to a non-mainstem reservoir, is that considerable effort has been put into developing a mechanism to encourage binational cooperation on the Colorado River.<sup>159</sup> This means that there is an existing framework for negotiation. This existing framework cuts both ways, however. Though Arizona and Mexico will not have to construct an agreement from the ground up, relying on the Law of the River may reduce the amount of flexibility in negotiations.

## 2. Drawbacks to Augmenting the Colorado River and the Power of the Secretary of the Interior as Water Master of the Lower Basin

Augmenting the Colorado River mainstem offers benefits beyond providing water to sustain the Southwest's growing population but relying on BICS does have drawbacks.<sup>160</sup> Specifically: (1) the prohibition on releasing water stored as BICS during shortage years; and (2) the need to secure forbearance agreements from numerous parties.<sup>161</sup> Both of these prerequisites pose substantial obstacles. Even so, the powers granted the Secretary of the Interior as water master of the Lower Basin may offer a method to circumvent these impediments.<sup>162</sup>

In times of shortage, the Secretary of the Interior has the power to unilaterally reallocate Colorado River allocations.<sup>163</sup> Because of this, a shortage in the Lower Basin would permit the Secretary to effectively override the provisions in the 2007 Guidelines that prohibit a release of

<sup>152</sup> JAY R, CEDERBERG ET AL., ESTIMATION OF DISSOLVED-SOLIDS CONCENTRATIONS USING CONTINUOUS WATER-QUALITY MONITORING AND REGRESSION MODELS AT FOUR SITES IN THE YUMA AREA, ARIZONA AND CALIFORNIA, JANUARY 2017 THROUGH MARCH 2019 25 (2021), <https://pubs.usgs.gov/sir/2021/5080/sir20215080.pdf>.

<sup>153</sup> 323 WORK GROUP REPORT TM3, *supra* note 40, at 38 (“The treated water will have a maximum total dissolved solids concentration of 500 mg/L, which could improve water quality when blended with native Colorado River water.”).

<sup>154</sup> Robert Glennon, *What is Dead Pool? A Water Expert Explains*, THE CONVERSATION, May 12, 2022, <https://theconversation.com/what-is-dead-pool-a-water-expert-explains-182495> [<https://perma.cc/JCS4-N4EM>].

<sup>155</sup> *Id.*

<sup>156</sup> *See id.*

<sup>157</sup> *See id.*

<sup>158</sup> *Id.*

<sup>159</sup> *See supra* Part I.C.2.

<sup>160</sup> *See supra* Part I.C.3.

<sup>161</sup> *Supra* Part I.C.3.

<sup>162</sup> *See generally supra* notes 79, 80, 86, and accompanying text (describing the powers of the Secretary of the Interior in the Lower Basin).

<sup>163</sup> *Supra* note 86 and accompanying text.

BICS by apportioning an additional allocation of water to the creator of the BICS credit. In this way a shortage in the Lower Basin would present a problem for BICS releases, but also a potential solution. Not only would this reallocation be legally permissible, but it would also constitute sound policy. By ensuring that the creator of a BICS credit can benefit from the credit during times of shortage, the Secretary of the Interior can incentivize continued augmentation.

The Secretary of the Interior's power as water master may also be used to supersede the forbearance agreements necessary for BICS releases.<sup>164</sup> This would be achieved in a similar manner to overriding the BICS-release prohibition during shortage years: the Secretary would simply reapportion allocations of Colorado River water to correspond to the amounts due each entity under a fully enacted BICS agreement where the necessary forbearance agreements had been secured.<sup>165</sup> Like overriding the BICS-release prohibition, the Secretary of the Interior could only exercise this power during times of shortage.<sup>166</sup> Also like overriding the BICS-release prohibition, exercising this power to supersede the need to secure forbearance agreements from all of the requisite parties constitutes sound policy because it will incentivize creation of new sources of water in the Colorado River basin.

As water master of the Lower Basin, the Secretary of the Interior has the ability to resolve these two significant concerns. Yet the Secretary has no obligation to act in this manner, and neither Arizona nor Mexico can directly compel the Secretary to act at all.<sup>167</sup> Though augmenting the Colorado River with desalted water does offer considerable benefits to both Arizona and Mexico, the risks associated with a BICS-based agreement must be carefully considered before grounding a transnational agreement in the Law of the River.

### *C. A "Bottom-Up" Agreement; Harnessing Local Expertise to Address Regional Needs*

If transferring water rights via BICS prove too risky or difficult, Arizona may attempt to negotiate a separate agreement with Sonora to desalt and convey water up to a reservoir not located on the Colorado River mainstem. By directly working with Sonora localities, Arizona may be able to reduce transaction costs and craft an agreement tailored specifically to the needs of the two states. This Part explores an Arizona-Sonora transboundary desalination agreement that does not rely on the Law of the River to transfer water rights. Three potential delivery locations are identified and considered: (1) Lake Pleasant; (2) Painted Rock Reservoir; and (3) the Southern and Central Avra Valley Storage and Recovery Projects (SAVSARP/CAVSARP). Before examining each delivery location individually, the benefits and downsides common to all locations are described.

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<sup>164</sup> See *supra* note 86 and accompanying text for an explanation of the Secretary's powers. See *supra* note 100 and accompanying text for a list of the parties from which a forbearance agreement is required for any ICS release.

<sup>165</sup> See *supra* note 86 and accompanying text.

<sup>166</sup> *Supra* notes 79, 80, 86 and accompanying text.

<sup>167</sup> See *Arizona v. California*, 373 U.S. 546, 594–95 (1963) (reasoning that the Secretary of the Interior's power over the Lower Basin is subject only to oversight from the United States Congress).

## 1. Benefits and Downsides Common to All Three Delivery Locations Not on the Colorado Mainstream

Unlike using BICS to transfer Colorado River rights, an agreement to convey desalinated water directly to Arizona reservoirs would have to be negotiated without the benefit of an existing transfer framework. But a direct-conveyance augmentation agreement might provide more protection from drought for Arizonans.<sup>168</sup> This is because Arizona users would receive every drop of desalinated water allocated to them (minus system losses and the amount allocated for use in Mexico).<sup>169</sup> Under a BICS transfer, an extreme shortage on the Colorado River could result in insufficient flow to pull the “credited” water from Lake Havasu—even though the desalination plant might be operating at full capacity.<sup>170</sup> Direct conveyance avoids this potential issue.

Delivering water directly to Arizonan end-users and avoiding the Colorado River reduces this specific drought risk for Arizona, but it is still prone to some of the same transaction costs as BICS. Any agreement between Arizona and Sonora will have to be approved by the United States<sup>171</sup> and Mexican governments.<sup>172</sup> This means that even if Arizona and Sonora are able to leverage the inter-local diplomacy of state and municipal authorities, some of the same transaction costs associated with Congressional approval of a BICS agreement may still be incurred.

Additionally, taxation, improvement grants, liability, and accountability are all tightly connected to territorial jurisdiction.<sup>173</sup> Because of this, a binational agreement that is not situated within a well-established framework (like the Law of the River) may result in Arizona’s communities having less oversight over desalinated water prior to its delivery.<sup>174</sup>

Even so, relevant similarities between Arizona and Sonora suggest that a “bottom-up” process starting with direct negotiation between the two neighboring states may be achievable. This is because Arizona and Sonora are confronting both factors motivating successful transboundary water sharing agreements along the United States-Canada border: (1) economics; and (2) water scarcity.<sup>175</sup>

First, both states stand to realize economic benefits under a transboundary augmentation agreement. Arizona’s potential benefit is the most obvious: access to an otherwise inaccessible water supply. Of course, a portion of any desalinated water must also be allocated to Sonoran communities. However, Sonora stands to gain other benefits as well. Northwestern Mexico lacks adequate water infrastructure; some communities on the Sea of Cortez do not even have regular access to reliable drinking water.<sup>176</sup> Under a transboundary augmentation agreement, Arizona-

<sup>168</sup> See *supra* text accompanying notes 111–114 (describing the risk of delivering desalinated water to the mainstem Colorado River downstream from the CAP’s diversion point at Lake Havasu).

<sup>169</sup> See *supra* text accompanying notes 111–114.

<sup>170</sup> See *supra* text accompanying notes 111–114.

<sup>171</sup> See *supra* Part I.C.1.

<sup>172</sup> This Note does not address the Mexican procedure for approving a transnational agreement between government subdivisions.

<sup>173</sup> Forest, *supra* note 117, at 20.

<sup>174</sup> See *generally id.* (finding that fragmented water governance structures result in beneficiary communities that have no “legal or formal say” in pre-delivery oversight of their water).

<sup>175</sup> See *supra* note 121 and accompanying text.

<sup>176</sup> See, e.g., Christopher A. Scott & Martin Pasqualetti, *Energy and Water Resources Scarcity: Critical Infrastructure for Growth and Economic Development in Arizona and Sonora*, 50 NAT. RES. J. 645, 655 (2010); Murphy Woodhouse, *Sonora to Get Nearly \$50M in Federal Aid for Water Infrastructure*, KJZZ, Jan. 11, 2022, <https://kjzz.org/content/1746968/sonora-get-nearly-50m-federal-aid-water-infrastructure> [<https://perma.cc/7AT3-DXBV>].

backed investment in Sonoran water infrastructure could contribute to meeting some of these pressing needs. Furthermore, should a desalination facility be co-located with renewable energy generation as suggested in this Note, it would represent a much-needed investment in Sonora's renewable energy infrastructure as well.<sup>177</sup>

Second, both states face water scarcity. Arizona's growth, coupled with drought and climate change, have resulted in a looming water crisis.<sup>178</sup> Sonora, too, is experiencing population growth, drought, and climate change.<sup>179</sup> The primary purpose of a cooperative transboundary desalination agreement is to help both states address these challenges.

Importantly, if Arizona and Sonora can craft a satisfactory agreement that is approved by the requisite national authorities, it may be more stable than a BICS-based agreement. Transboundary agreements based on local partnerships are "characterized by their longevity."<sup>180</sup> In addition to the inherent stability of an agreement founded on the knowledge and need of local leaders, by avoiding the Law of the River Arizona and Sonora may also avoid future volatility resulting from stress on the Colorado River.

## **2. Merits of Specific Delivery Locations Not on the Colorado River Mainstream**

An Arizona-Sonora agreement based on local partnership is likely achievable and can deliver many of the same benefits as a BICS-based agreement can—at least in theory.<sup>181</sup> A bottom-up agreement may also be able to avoid some of the risks and transaction costs associated with a BICS-based agreement.<sup>182</sup> In order to compare the relative merits of a BICS-based agreement with an augmentation agreement that delivers water to a location other than the Colorado River mainstream, this Part identifies and briefly analyzes three potential alternative delivery locations: (1) Lake Pleasant; (2) Painted Rock Reservoir; and (3) SAVSARP/CAVSARP.

### *i. Lake Pleasant*

Lake Pleasant is the CAP's main storage reservoir.<sup>183</sup> Its water comes from both the Colorado and Agua Fria Rivers.<sup>184</sup> It is in central Arizona, near the middle of the CAP system, and has an 812,100 acre-foot storage capacity.<sup>185</sup>

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<sup>177</sup> See Scott & Pasqualetti, *supra* note 176, at 655–57.

<sup>178</sup> See *supra* notes 3 to 18 for an overview of how Arizona's population growth and water stressors has led to water scarcity in the state.

<sup>179</sup> See Scott & Pasqualetti, *supra* note 176, at 656–57.

<sup>180</sup> Forest, *supra* note 117, at 17.

<sup>181</sup> See *supra* Part II.B.1 for a discussion of benefits that a BICS-based transfer agreement may deliver.

<sup>182</sup> See *supra* Parts I.B.3 and II.C.1 (discussing hurdles to a BICS-based agreement and advantages of a direct-conveyance agreement, respectively).

<sup>183</sup> *Lake Pleasant*, CENTRAL ARIZ. PROJECT, <https://www.cap-az.com/water/cap-system/water-operations/lake-pleasant/> [<https://perma.cc/4VDV-6F6C>] (last visited Dec. 1, 2022).

<sup>184</sup> *Id.*

<sup>185</sup> *Id.*; *Phoenix Area Office – Facilities New Waddell Dam*, U.S. BUREAU OF RECLAMATION, <https://www.usbr.gov/lc/phoenix/projects/waddellproj.html> [<https://perma.cc/2KVQ-K2Z3>] (last visited Dec. 6, 2022).

Lake Pleasant's size and location are both ideal for a delivery point. It is already used to provide water to the Phoenix and Tucson metro areas, and it has considerable capacity for storage. However, Lake Pleasant is over 200 miles from the Arizona-Sonora border—and even farther from any possible desalination facility.<sup>186</sup> There are at least three complications caused by this distance. First, the costs of piping and pumping infrastructure increase with distance. Second, all reasonable routes from the Sea of Cortez to Lake Pleasant cross the Barry M. Goldwater Air Force Bombing Range.<sup>187</sup> It is unclear whether the United States' military will condone transporting water across this land.<sup>188</sup> Third and finally, successful transboundary water sharing agreements are generally found between neighboring communities.<sup>189</sup> Here, the substantial geographic separation between Lake Pleasant and the Sea of Cortez may reduce the likelihood of crafting a successful local partnership.

*ii. Painted Rock Reservoir*

Painted Rock Reservoir is located southwest of Phoenix in the Gila River Basin and has an estimated 2.1 MAF capacity.<sup>190</sup> The dam creating the reservoir—Painted Rock Dam—is the last dam on the Gila River before its confluence with the Colorado River.<sup>191</sup> It was constructed primarily for flood control purposes.<sup>192</sup>

There are three notable benefits of an augmentation agreement that delivers water to Painted Rock Reservoir. First, the reservoir has massive storage capacity, only exceeded in Arizona by Roosevelt Lake.<sup>193</sup> Second, the reservoir is located relatively close to the Arizona-Sonora border and water delivered there would directly benefit the border city of Yuma, potentially increasing the likelihood of a successful bottom-up partnership.<sup>194</sup> And third, an influx of purified water into the lower Gila River would mitigate runoff contamination in the Gila Basin as well as reduce the concentration of dissolved solids in the Colorado River Delta.<sup>195</sup>

Despite these benefits, Painted Rock Reservoir has serious shortcomings when compared to other potential delivery locations. Like Lake Pleasant, any reasonable route from the Sea of Cortez to Painted Rock Reservoir must cross the Barry M. Goldwater Bombing Range.<sup>196</sup> More importantly, however, is its location. Desalinated water delivered to Painted Rock would not

<sup>186</sup> See generally 323 WORK GROUP REPORT TM3, *supra* note 40 at 201 (identifying Playa Encanto—a small coastal community on the northeastern Sea of Cortez—as a potential desalination facility location located close to Arizona).

<sup>187</sup> See ARIZ. STATE LAND DEP'T & U.S. BUREAU OF LAND MGMT., ARIZONA SURFACE MANAGEMENT RESPONSIBILITY (2019), <https://land.az.gov/sites/default/files/media/state.pdf>.

<sup>188</sup> See generally 323 WORK GROUP REPORT TM3, *supra* note 40 at 21 (indicating that water cannot be conveyed across the Barry. M. Goldwater Bombing Range).

<sup>189</sup> See *supra* Part I.C.

<sup>190</sup> *Painted Rock Dam*, U.S. ARMY CORPS OF ENG'RS, L.A. DIST., <https://resreg.spl.usace.army.mil/pages/ptrk.php> [<https://perma.cc/ATX4-J7T4>] (last visited Dec. 2, 2022) (listing a spillway crest of approximately 2.3 MAF, minus an estimated 200,000 acre-feet sediment allowance).

<sup>191</sup> *Id.*

<sup>192</sup> *Id.*

<sup>193</sup> John Dougherty, *Contaminated Splendor*, PHX. NEW TIMES, March 10, 2005, <https://www.phoenixnewtimes.com/news/contaminated-splendor-6397498> [<https://perma.cc/F9PA-DYGF>].

<sup>194</sup> See generally Forest, *supra* note 117, at 16, n.6 (reporting evidence that border communities are more successful at crafting stable transboundary water agreements).

<sup>195</sup> See *id.*; *supra* notes 149–153 and accompanying text.

<sup>196</sup> See ARIZ. STATE LAND DEP'T & U.S. BUREAU OF LAND MGMT., *supra* note 187.

directly benefit any of Arizona's primary population centers. Though the water would ultimately end up in the Colorado River (about a dozen miles upstream of the Morelos Dam) and would thus be eligible for a BICS transfer benefiting CAP users, this implicates the issues outlined in Part I.C.3. Accordingly, delivery to Painted Rock Reservoir should not be seriously considered because it incorporates all the drawbacks of a BICS-based agreement as well as all of the drawbacks of a bottom-up partnership.

*iii. Avra Valley Storage*

The most promising delivery point for a bottom-up partnership is SAVSARP/CAVSARP. These facilities are adjacent to one another in Avra Valley, west of the southern Arizona city of Tucson.<sup>197</sup> Unlike Lake Pleasant or Painted Rock, the Avra Valley facilities store water underground by recharging naturally occurring aquifers.<sup>198</sup> SAVSARP/CAVSARP are located near the CAP's terminus; together the two projects manage the majority of Tucson's annual Colorado River allocation.<sup>199</sup>

Compared to other potential non-mainstem delivery locations, delivering desalinated water to SAVSARP/CAVSARP has three considerable advantages. First, unlike reservoirs in western or central Arizona, purified water can be piped directly from the Sea of Cortez to the Avra Valley without crossing any federal bombing ranges.<sup>200</sup> Second, the Avra Valley is located close to the border, about fifty miles. Third—and most importantly for inter-local negotiations—the nearby twin cities of Nogales, Arizona and Nogales, Sonora already have a history of water collaboration.<sup>201</sup> This history of cross-border cooperation in the area provides a promising foundation for a larger-scale transboundary agreement.

Though delivering water to SAVSARP/CAVSARP is a promising option for Arizona and Sonora, there are some potential complications. One possible complication is ensuring that Sonora directly benefits from new water created by a desalination facility. Unlike a BICS-based agreement to deliver water to Morelos dam, or even directly conveying desalted water to Painted Rock Reservoir, using the Avra Valley facilities as a delivery point will not necessarily augment the Colorado River. Because of this, the desalted water will only increase water availability in Sonora if a portion of the water is delivered to a reservoir in Mexico. This, of course, can be arranged for in an agreement, but the addition of another delivery point—and the necessary infrastructure to convey the water—will also increase the costs of the agreement.<sup>202</sup>

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<sup>197</sup> *Central Avra Valley Storage and Recovery Project (CAVSARP)*, CITY OF TUCSON, <https://www.tucsonaz.gov/water/cavsarp> [https://perma.cc/UP63-Y3ZV] (last visited Dec. 4, 2022).

<sup>198</sup> *Id.*; *Southern Avra Valley Storage and Recovery Project (SAVSARP)*, CITY OF TUCSON, <https://www.tucsonaz.gov/water/savsarp> [https://perma.cc/MY2Q-GLNM] (last visited Dec. 4, 2022).

<sup>199</sup> See *Central Avra Valley Storage and Recovery Project (CAVSARP)*, *supra* note 197.

<sup>200</sup> See *supra* notes 187, 188 and accompanying text.

<sup>201</sup> TERRY W. SPROUSE, WATER ISSUES ON THE ARIZONA-MEXICO BORDER 4 (2005), <https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/Water%20Issues%20on%20the%20Arizona%20Mexico%20Border.pdf>.

<sup>202</sup> See generally *supra* I.C.3 (describing hurdles to a BICS-based agreement that may lead to increased costs).

There is also another way in which Sonora can directly increase its water supply and security. Because SAVSARP and CAVSARP already handle the majority of Tucson's Colorado River allocation,<sup>203</sup> Tucson could elect to forgo some of its allocation and credit it to Sonora under an ancillary BICS agreement. Though this undoubtedly adds transaction costs to a potential agreement, it may prove less costly than the construction of additional infrastructure.

Similarly, though delivering water to the Avra Valley does not directly benefit Arizonans living in the Phoenix metro area, water allocations could be transferred from one city to the other. Here too, transferring water allocations will complicate an agreement.<sup>204</sup> Even so, transferring CAP water rights may prove simpler than executing a BICS deal.<sup>205</sup>

Finally, delivering desalinated water to the Avra Valley may have unique issues because of the method of storage at SAVSARP/CAVSARP. Once the desalted water is stored underground, it becomes part of Arizona's groundwater regime and is subject to different rules and regulations. Though an in-depth exploration of these issues is not warranted here, it is worth noting that it may inject additional challenges as well as opportunities into an agreement.<sup>206</sup>

#### ***D. The Importance of Community Consultation and Coordination***

In early 2023, the Governor of Sonora rejected an Arizona desalination scheme that shared relevant similarities to the top-down agreements described in this Essay.<sup>207</sup> The mistakes made when crafting this scheme may prove instructive and warrant a brief discussion here. This Part shows how a bottom-up process would have avoided these mistakes.

It should be self-evident that any transnational agreement (whether “bottom-up” or “top-down”) must benefit both Sonora and Arizona. Despite this, at the end of 2022, Arizona's Water Infrastructure Finance Authority (WIFA) began pushing a desalination scheme without adequately consulting Sonoran authorities.<sup>208</sup> Less than two months later, Sonora's governor rebuffed Arizona's advances and harshly criticized the company in charge of constructing the desalination facility, objecting to its “lack of ethics.”<sup>209</sup> An agreement based on community coordination and local needs—and not a unilateral, extractive approach—would not face this same sort of resistance.

This failed unilateral approach is caused in part by WIFA's statutory powers and duties. In July 2022, Arizona Governor Doug Ducey signed a bill that greatly enhanced WIFA's power and

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<sup>203</sup> See *Central Avra Valley Storage and Recovery Project (CAVSARP)*, *supra* note 197.

<sup>204</sup> See generally *supra* I.C.3 (describing hurdles to a BICS-based agreement).

<sup>205</sup> This is because water in the CAP canals downstream from Lake Pleasant (i.e., between the Phoenix and Tucson areas) contains a significant amount of Agua Fria water—which is not controlled by the Law of the River. See LLOYD O. BARNETT ET AL., RECONNAISSANCE WATERSHED AND HYDROLOGIC ANALYSIS ON THE UPPER AGUA FRIA WATERSHED 28 (2002), <https://new.azwater.gov/sites/default/files/UppAguFriWatRep.pdf> (finding that the Agua Fria has historically had a median flow of 39,000 acre-feet a year where it enters Lake Pleasant).

<sup>206</sup> See generally NAT'L RES. CONSERVATION SERV., U.S. DEP'T OF AGRIC., NATIONAL ENGINEERING HANDBOOK PART 631.33 (2010) (listing several benefits and drawbacks of groundwater recharge).

<sup>207</sup> Hunter Bassler, *Future of Arizona's Desalination Dreams Dashed by Sonora's Governor*, 12 NEWS, Feb. 2, 2023, <https://www.12news.com/article/news/local/water-wars/desalination-plant-sonora-governor-alfonso-durazo-lack-ethics/75-d478b85d-e9bd-4ebb-bfaf-13752f4bcc7d> [<https://perma.cc/3P2C-G2DL>].

<sup>208</sup> Sharon Udasin, *Project Would Pipe Water from Mexico to Parched Arizona—If Anyone Can Agree On It*, THE HILL, Feb. 20, 2023, <https://thehill.com/policy/equilibrium-sustainability/3864051-project-would-pipe-water-from-mexico-to-parched-arizona-if-anyone-can-agree-on-it/> [<https://perma.cc/TD7H-6H9P>].

<sup>209</sup> Bassler, *supra* note 207.

authority.<sup>210</sup> One of WIFA’s enhanced powers is to independently negotiate and enter into intergovernmental agreements, including agreements with governmental entities outside of Arizona.<sup>211</sup> Though WIFA has the authority to negotiate with extra-territorial entities, its legislative mandate is clear: this authority may only be exercised for the benefit of Arizona residents.<sup>212</sup>

When WIFA recommended desalting and importing water from the Sea of Cortez, it was similarly clear that the proposal was intended to solely benefit Arizona.<sup>213</sup> When listing the goals of the proposal, WIFA mentioned Arizona’s future water needs and how the proposal might attract new companies to Arizona.<sup>214</sup> It did not mention any Sonoran benefits.<sup>215</sup> Further complicating things, WIFA was criticized for failing to work closely with local authorities in Arizona,<sup>216</sup> for proposing to commit millions of taxpayer dollars without adequate oversight, and for inadequately considering the environmental impacts of desalination.<sup>217</sup> These issues could have been addressed by using a bottom-up negotiation process.

Instead of rushing through a top-down proposal, WIFA could have taken the time to meet with border communities, listen to their needs, and build on existing transborder cooperation.<sup>218</sup> It could have pledged funding to repair Sonoran water infrastructure and committed an equitable portion of desalted water to Sonoran users. It could have addressed environmental concerns with communities most likely to be impacted by desalinating and delivering desalted water. It could have relied on community leaders to help craft a robust agreement before presenting it to a central authority for approval. Had it done so, its transnational desalination proposal would have been much more likely to succeed.

## CONCLUSION

This Note makes three important contributions to the ongoing water dialogue in the North American Southwest. First, it establishes how the Law of the River could be used to help facilitate a transnational desalination agreement. Second—and more importantly—it proposes a better way to proceed: listening to local leaders on both sides of the border and building on their communities’ needs. Finally, it identifies a promising location to deliver desalinated water that avoids the risks of a top-down agreement and builds on existing transboundary water cooperation.

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<sup>210</sup> 2022 Ariz. Sess. Laws § 15.

<sup>211</sup> ARIZ. REV. STAT. ANN. § 49-1203.01(B)(3) (2022).

<sup>212</sup> Also, for the benefit of Arizona’s environment and economy. ARIZ. REV. STAT. ANN. § 49-1205(B) (2022).

<sup>213</sup> WATER INFRASTRUCTURE FINANCE AUTHORITY OF ARIZ., RESOLUTION 2023-027—IDE TECHNOLOGIES PROPOSAL 1 (2022), <https://perma.cc/47BM-GH2T>.

<sup>214</sup> *Id.*

<sup>215</sup> *See id.*

<sup>216</sup> *Cf.* Joshua Partlow, *Amid Drought, Arizona Contemplates a Fraught Idea: Piping In Water from Mexico*, WASH. POST, Dec. 23, 2022, <https://www.washingtonpost.com/climate-environment/2022/12/23/arizona-mexico-water-pipeline-project/> [<https://perma.cc/44RG-3FSL>] (describing the plan as “new to many” and worrying to some).

<sup>217</sup> *Id.*

<sup>218</sup> *See, e.g., supra* note 26 (describing Sonora’s water needs); *supra* note 201 (noting an example of Arizona-Sonora inter-local water cooperation).

Arizonans and Sonorans must now confront new challenges and opportunities to maintain their desert oases. Both states are growing and must secure new sources of fresh water to continue to grow safely. Though desalinating water from the Sea of Cortez may pose some environmental challenges, these challenges can be overcome with appropriate preparation. Similarly, the legal and political obstacles can be overcome with proper planning. BICS provides a robust transboundary transfer mechanism. Despite the hurdles and risks of harnessing the Law of the River, a BICS-based agreement can undoubtedly offer considerable benefits. Even more promising, however, is an agreement—founded on local cooperation and knowledge—to desalinate and convey water to the Avra Valley for groundwater recharging. Such an agreement could offer all of the benefits of a BICS-based agreement, with fewer risks. Such an agreement must still overcome many challenges before it can become reality, but transboundary water augmentation is both legal and feasible. For the Southwest to continue to thrive, it may also be necessary.