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Rethinking Transboundary Ground Water Resources Management: A Local Approach along the Mexico-U.S. Border

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ABSTRACT

Despite more than forty years of promises to the contrary, neither Mexico nor the United States have shown any inclination to pursue a border-wide pact to coordinate management of the border region's transboundary ground water resources. As a result, these critical resources—which serve as the sole or primary source of fresh water for most border communities on both sides—are being overexploited and polluted, leaving the local population with little recourse. Imminently unsustainable, the situation portends a grim future for the region.

In the absence of national governmental interests and involvement on either side of the frontier, this article advocates an alternative approach, one that sidesteps the respective federal authorities. It proposes that subnational entities at the regional and local level pursue cooperation in the form of locally-specific, cross-border arrangements. These may take the form of informal memorandum of understanding, or more structured contracts for goods or services. Under the unique circumstances of the Mexico-U.S. border, such arrangements are likely more achievable and apt to create viable cross-border pacts that would be respected by the local communities. Moreover, they are more likely to achieve a sustainable and water-secure future for the border, its communities, and the natural environment.

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I. INTRODUCTION

The nearly 2,000 mile-long border between Mexico and the United States is hot and dry. Few rivers cross this arid expanse. Nevertheless, despite the lack of visible, life-sustaining water, the region is growing—the combined border population, currently around 14.4 million, is expected to increase forty percent by 2020.[1] Ground water, in the form of transboundary aquifers, makes this growth possible. As many as twenty aquifers straddle the Mexico-U.S. border, many of which serve as the primary or sole source of fresh water for overlying populations and ecosystems.[2]

Despite the undeniable importance of the region's transboundary ground water resources, Mexico and the United States have never penned an agreement addressing the allocation and management of these aquifers. While various recommendations have been proffered over the years,[3] all appear to have fallen

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1. GOOD NEIGHBOR ENVTL. BD., A BLUEPRINT FOR ACTION ON THE U.S.-MEXICO BORDER: THIRTEENTH REPORT OF THE GOOD NEIGHBOR ENVTL BOARD TO THE PRESIDENT AND THE CONGRESS OF THE U.S. 3 (June 2010) *available at* http://www.epa.gov/ocem/gneb/gneb13threport/English-GNEB-13th-Report.pdf [hereinafter GNEB 13] (suggesting that the combined border population may grow from 14.4 million people in 2010 to around 20 million in 2020).

2. *See infra* note 14, 15, 19, and accompanying text.

3. For reports and journal articles recommending a comprehensive transboundary aquifers agreement between Mexico and the United States, *see e.g.*, Barbara G. Burman & Thomas G. Cornish, *Needed: A Ground-Water Treaty Between the United States and Mexico*, 15 NAT. RESOURCES J. 385 (1975); Stephen P. Mumme, *The U.S.-Mexican Conflict Over Transboundary Groundwaters: Some Institutional and Political Considerations*, 12 CASE W. RES. J. INT'L L. 505 (1980); Ann Berkley Rodgers & Albert E. Utton, *The Ixtapa Draft Agreement Relating to the Use of Transboundary Groundwaters*, 25 NAT. RESOURCES J. 713 (1985); Stephen P. Mumme, Apportioning Groundwater Beneath the U.S.-Mexico Border: Obstacles and Alternatives, Research Report Series No. 45, Center for U.S.-Mexican Studies (1988); Robert D. Hayton & Albert E. Utton, *Transboundary Groundwaters: The Bellagio Draft Treaty*, 29 NAT. RESOURCES J. 663 (1989); Diane M. Barber, *The Legal Dilemma of Groundwater Under the Integrated Environmental Plan for the Mexican-United States Border Area*, 24 ST. MARY'S L.J. 639 (1992-1993); Adrienne Paule, *Underground Water: A Fugitive at the*

on deaf ears. This is likely because of the disinclination of the respective federal governments to address an issue that may be both politically sensitive and of little diplomatic significance in the larger scheme of Mexican-U.S. relations. The herculean effort that would be required to achieve such an accord, due to the multitude of jurisdictions and stakeholders and the complicated nature of water politics in the United States, gives federal officials on both sides reason for concern.[4] Additionally, compared to the issues of illegal immigration, drug violence, economic trade, and other border and non-border issues, ground water management ranks relatively low among the priorities of both federal governments.[5]

As a result, the region's ground water resources are being overexploited on both frontiers as populations and industries pump with little regard for sustainability or transboundary consequences.[6] Moreover, these finite subsurface reservoirs are being fouled by untreated wastes, agricultural and industrial by-products, and other sources of pollution. Ultimately, the viability of the region's communities, natural environment, and economic growth are threatened with stagnation and may falter. And no one, at least on the federal level, is doing anything about it.

If both federal governments remain unwilling to take decisive steps toward the proper and sustainable management of these vital fresh water resources, what else can be done? Are there any alternatives to a formal, comprehensive, border-wide regime that would address the complexity and multitude of issues related to the various transboundary aquifers on the border?

A new approach must be identified, a new paradigm for the administration of transboundary aquifers along the Mexico-U.S. frontier. This article proposes such an approach, one that sidesteps the authority of the respective federal

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Border, 13 PACE ENVTL. L. REV. 1129 (1996); Marilyn C. O'Leary, *The Bellagio Draft Treaty as a Tool for Solving Border Groundwater Issues*, 11 U.S.-MEX. L.J. 57, 58 (2003); Amy Hardberger, *What Lies Beneath: Determining the Necessity of International Groundwater Policy Along the United States-Mexico Border and a Roadmap to an Agreement*, 35 TEX. TECH L. REV. 1211 (2004); Robert C. Gavrell, *The Elephant Under the Border: An Argument for a New, Comprehensive Treaty for the Transboundary Waters and Aquifers of the United States and Mexico*, 16 COLO. J. INT'L ENVTL. L. & POL'Y 189 (2005); Philip Dunlap, Comment, *Border Wars: Analyzing the Dispute Over Groundwater Between Texas and Mexico*, 12 L. & BUS. REV. AM. 215 (2006); 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, 97 (2008).

Two notable exceptions are a pair of student comments, one suggesting a formal regional agreement to be crafted between Mexico and a state or local government sharing a specific transboundary aquifer, while the other advocates for a basin-by-basin approach to international agreements on the border. *See* Jennifer Evans, *Transboundary Groundwater in New Mexico, Texas, and Mexico: State and Local Legal Remedies to a Challenge Between Cities, States, and Nations*, 30 WM. & MARY ENVTL. L. & POL'Y REV. 471 (2006) and Robert E. Hall, *Transboundary Groundwater Management: Opportunities Under International Law for Groundwater Management in the United States-Mexico Border Region*, 21(3) ARIZ. J. INT'L & COMP. L. 873 (2004).

4. *See* infra notes 56-80 and accompanying text.

5. *See* Maria Rosa Garcia-Acevedo & Helen Ingram, *Conflict in the Borderlands*, 38 NACLA REP. ON THE AMERICAS 19, 24 (2004) (recognizing that "Groundwater is not highly ranked among the many issues that crowd the bilateral agenda").

6. *See infra* notes 26-31 and accompanying text.

governments and places the burden of pursuing cross-border cooperation on the local communities that so depend on these critical fresh water resources. While this tactic challenges the two national governments' traditional monopoly over international relations, especially as they relate to transboundary natural resources, there is good reason to believe that locally-relevant, cross-border pacts could achieve what Mexico City and Washington, DC have failed (or declined) to do—create effective collaborative schemes for the mutual and sustainable management of the region's transboundary ground waters.

Before presenting this new paradigm, this article considers ground water and its use along the Mexico-U.S. border as well as the impact that population growth and economic development have had on this fragile water resource. It then addresses some of the challenges facing the two nations in achieving a formal agreement over the border-region's transboundary aquifers. Following this introductory material, the article proffers a methodology for pursuing cross-border cooperation over these shared resources on a subnational basis. This article takes the position that a local and regional approach to transboundary aquifer administration would be a viable and possibly preferable alternative to a formal, border-wide treaty. By taking the initiative, through quasi-formal and informal arrangements,[7] neighboring communities on opposing sides of the frontier can achieve sustainable management of their most critical natural resource, in spite of the federal authorities.[8]

II. THE MEXICO-U.S. BORDER REGION

A. A PARCHED BORDER

The boundary between Mexico and the United States stretches 1,954 miles from the Gulf of Mexico to the Pacific Ocean.[9] For the most part, the region is an arid environment ranging from semi-arid steppe along the Rio Grande in the eastern portion of the border to dry desert in the western section.[10] The Rio Grande comprises 1,250 miles of the lengthy Mexico-U.S. border, flowing from Ciudad Juarez-El Paso, in the Chihuahua-Texas border area, to the Gulf of

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7. As used in this article, the term *arrangement* denotes an agreement between two or more subnational parties on either side of the border, such as municipalities, water utilities, and ground water conservation districts that may or may not have the force of law. *See infra* note 123-137 and accompanying text.

8. It is noteworthy that as far back as a quarter century ago, a U.S. Congressional commission on migration concluded "'that a unique culture has developed [on both sides of the border], one quite distrustful of initiatives coming from either Washington or Mexico City.'" *See* Roberto Ham-Chande & John R. Weeks, *A Demographic Perspective of the U.S.-Mexico Border*, *in* DEMOGRAPHIC DYNAMICS OF THE U.S.-MEXICO BORDER 1, 2 (1992) (quoting from REPORT OF THE U.S. COMM'N FOR THE STUDY OF INT'L MIGRATION AND COOP. ECON. DEV. 90 (1990)).

9. INT'L BOUNDARY AND WATER COMM'N, Boundary Map, *available at* http://www.ibwc.gov/Files/US-Mx_Boundary_Map.pdf (*last visited Jan. 26, 2013*).

10. *See* Diana M. Liverman, et. al., *Environmental Issues Along the United States-Mexico Border: Drivers of Change and Responses of Citizens and Institutions*, ANN. REV. ENERGY & ENV'T 607, 610 (1999).

Mexico near Matamoros, Tamaulipas in Mexico and Brownsville, Texas, in the United States. West of Ciudad Juarez-El Paso, few rivers traverse the expanse and none in any meaningful quantity. Even the mighty Colorado River is now a shadow of its former self, decimated by dams and diversions constructed throughout its length in the United States and an overall decrease in precipitation.[11] Today, rainfall averages 500-750 mm along the eastern section of the border near the Gulf of Mexico, plummets to 50-100 mm in the Sonora-Arizona region, and increases slightly in the Baja California-California area to a still scant 100-250 mm.[12] Over the next century, though, various climate models project a more arid environment in which surface runoff in the border area will decline by 10-30%.[13]

Transboundary aquifers, however, underlay large segments of the frontier. Numerous wells dot the landscape and millions of people on both side of the border rely heavily on the region's ground water resources. The Hueco Bolson Aquifer, for example, supplies nearly all of the fresh water used by Ciudad Juarez's 1.5 million residents, and more than one-quarter of that used by El Paso's 833,000 residents.[14] For other border communities, these aquifers provide the sole source of fresh water for hundreds of miles, including for the numerous "sister cities" that bisect the border.[15]

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11. Flows that once exceeded 10,000 acre-feet annually in the Colorado River's lower reaches, as measured below all major dams and diversions near the border, are now barely recordable. *See* Kevin G. Wheeler, et al., *Alternatives for Restoring the Colorado River Delta*, 47 NAT. RESOURCES J. 917, 959 (2007). *See also* U.S. GEOLOGICAL SURVEY, CLIMATIC FLUCTUATIONS, DROUGHT, AND FLOW IN THE COLORADO RIVER BASIN (Aug. 2004), *available at* http://pubs.usgs.gov/fs/2004/3062/pdf/fs2004-3062_version2.pdf (demonstrating that average annual flows in the Colorado River, measured at Lee's Ferry [just below Lake Powell at Glen Canyon Dam in Arizona], dropped from over 15 million acre-feet early in the 1900s to just over 5 million acre-feet in the 2000s).

12. NAT'L WATER COMM'N OF MEX., STATISTICS ON WATER IN MEXICO 27 (Jun. 2010), *available at* http://www.conagua.gob.mx/CONAGUA07/Publicaciones/Publicaciones/SGP-6-10-EAM2010Ingles.pdf.

13. *Id.* at 177; GNEB 13, *supra* note 1, at 10.

14. TEX. WATER DEV. BD., FAR WEST TEXAS WATER PLAN, 1-47, 1-70, 1-71 (Jan. 2011), [hereinafter FAR WEST TEXAS WATER PLAN] *available at* http://www.twdb.state.tx.us/wrpi/rwp/3rdRound/2011_RWP/RegionE/PDF's/Complete_Final_Report.pdf; Zhuping Sheng & Jeff Devere, *Understanding and managing the stressed Mexico-USA transboundary Hueco bolson aquifer in the El Paso del Norte region as a complex system*, 13 HYDROGEOLOGY J. 813, 814 (2005).

15. Sister cities, also known as twin cities, are urban areas along the border that, but for the international border, would be a single, contiguous community. *See* Ham-Chande & Weeks, *supra* note 8, at 9. The most prominent of the border's sister cities entirely dependent on ground water include: Puerto Palomas (Chihuahua) and Columbus (New Mexico), Naco (Sonora) and Bisbee (Arizona), Nogales (Sonora) and Nogales (Arizona), Sonoyta (Sonora) and Lukeville (Arizona), and Tecate (Baja California) and Tecate (California). Blake Johnston et al., *Groundwater in the West Conference Reports*, 8 U. DENV. WATER L. REV. 328, 335. *See also* TERRY W. SPROUSE, WATER ISSUES ON THE ARIZONA-MEXICO BORDER: THE SANTA CRUZ, SAN PEDRO AND COLORADO RIVERS 4 (2005), *available at* http://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/Water%20Issues%20on%20the%20Arizona%20Mexico%20Border.pdf; Elaine Moore Hebard, *Jointly Managing a Transboundary Aquifer: A Binational Dialogue Through Community Participation and Education*, *in* CROSS BORDER WATERS: FRAGILE TREASURES FOR THE 21ST CENTURY 39 (1998); U.S. ENVTL. PROT. AGENCY (EPA), WATER SUPPLY, WASTEWATER COLLECTION AND TREATMENT PROJECT FOR THE CITY OF NACO, SONORA, MEXICO (Sept. 18, 1997), *available at* http://www.epa.gov/region9/border/infrastructure/becc/nacofea.pdf (providing an example of border waste-

These transboundary aquifers, however, also represent a critical source of fresh water for the border-region's distinct environment. For example, the Mexicali Valley-Imperial Valley Aquifer, which straddles the Mexico-U.S. border near the cities of Mexicali in Baja California and Calexico in California, links hydrologically to and serves as a major source of water for the Andrade Mesa Wetlands in Northern Mexico.[16] The Wetlands provide a critical migratory habitat for some 100 species of birds.[17] Throughout the border, water-dependent ecosystems create unique habitats for an estimated 450 species.[18]

Despite the significance that ground water resources play in the border region, little is known about the geographic range, volume, flow direction, quality, and renewability of most of these underground treasures. In fact, the location and actual number of all of the aquifers traversing the frontier has yet to be formally determined, though counts range between eight and twenty.[19]

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water infrastructure projects).

16. *See* Francisco Zamora Arroyo, et.al., *Looking Beyond the Border: Environmental Consequences of the All-American Canal Project in Mexico and Potential Binational Solutions, in* SCERP MONOGRAPH SERIES NO. 13 THE U.S. MEXICAN BORDER ENVIRONMENT, LINING THE ALL-AMERICAN CANAL: COMPETITION OR COOPERATION FOR WATER IN THE U.S.-MEXICAN BORDER? 21, 28 and 29 (Vicente Sanchez Munguia ed., 2006), *available at* http://www.scerp.org/pubs/mono13.htm (last visited Jan. 28, 2013); *see generally* Osvel Hinojosa-Huerta, et.al., *Andrade Mesa Wetlands of the All-American Canal*, 42 NAT. RESOURCES J. 899 (2002).

17. Arroyo, *supra* note 16, at 32, 35.

18. *See* Garcia-Acevedo & Ingram, *supra* note 5, at 20.

19. For example, the Good Neighbor Environmental Board (GNEB), an independent U.S. Presidential advisory committee, suggested in its 2005 report that eighteen to twenty aquifers may underlie the border. *See* GOOD NEIGHBOR ENVTL. BD., WATER RESOURCES MANAGEMENT ON THE U.S.-MEXICO BORDER EIGHTH REPORT TO THE PRESIDENT AND CONGRESS OF THE U.S. 24 (Feb. 2005) *available at* http://www.epa.gov/ocem/gneb/gneb8threport/gneb8threport.pdf. In its 2010 report, however, the GNEB avoids offering any estimation on the number of aquifers traversing the border. Rather, the report notes the existence of "several transboundary aquifers" and asserts that a lack of adequate and accurate data has resulted in "knowledge about groundwater resources in the border region [lagging] far behind that on surface waters." GNEB 13, *supra* note 1, at 10, 31. Other studies suggest that there are as few as eight and as many as eighteen. *Compare* UNESCO/OAS ISARM AMERICAS PROGRAMME—TRANSBOUNDARY AQUIFERS OF THE AMERICAS, 2005 FINAL REPORT: 2ND COORDINATION WORKSHOP, EL PASO, TX (Nov. 10-12, 2004), *available at* http://www.oas.org/dsd/isarm/Documents/English/ISARM%20Americas%202004-%20El%20Paso%20Workshop%20Report.pdf (identifying eight aquifers on the Mexico-U.S. border) *with* INTERNATIONAL GROUNDWATER RESOURCES ASSESSMENT CENTRE [hereinafter IGRAC], TRANSBOUNDARY AQUIFERS OF THE WORLD, map at 1 : 50 000 000 (2009), *available at* http://www.un-igrac.org/dynamics/modules/SFIL0100/view.php?fil_Id=121 (last visited Jan. 28, 2013) (depicting ten transboundary aquifers on the Mexico-U.S. border) *and* Stephen P. Mumme, *Minute 242 and Beyond: Challenges and Opportunities for Managing Transboundary Groundwater on the Mexico–U.S. Border*, 40 NAT. RESOURCES J. 341 (2000) [hereinafter Mumme 2000] (referencing eighteen transboundary aquifers on the border). The most recent assessment on transboundary aquifers globally, prepared by the International Hydrological Programme of the U.N. Educational, Scientific and Cultural Organization, reports ten transboundary aquifers on the Mexico-U.S. border. INTERNATIONALLY SHARED AQUIFER RESOURCES MANAGEMENT, ATLAS OF TRANSBOUNDARY AQUIFERS 94 (2009), *available at* http://www.isarm.net/publications/324.

B. TROUBLED WATERS

Lack of information about the region's aquifers has not prevented the border from booming. Between 2000 and 2010, the region's population grew by 16% to 14.4 million.[20] Much of this growth occurred in the fourteen sister cities that share the border.[21] With a growth rate exceeding average rates in Mexico and the United States, population in the border region is expected to reach nearly 20 million by 2020.[22] As a result, reliance on the region's transboundary aquifers continues to grow. For example, in 2005, California, Texas, Arizona, and New Mexico ranked first, second, seventh, and thirteenth, respectively, in fresh ground water withdrawals nationally.[23] In Arizona and Sonora, projections show municipal demand for water doubling over the next ten to twenty years.[24]

Years of unfettered exploitation have left the region's aquifers physically depleted.[25] For example, between 1940 and 1999, the water table of the Hueco Bolson aquifer, which underlies both Ciudad Juarez and El Paso, fell by as much as 45 meters,[26] leading some to forecast the aquifer's demise by 2025.[27] While the rate of the Hueco Bolson's depletion has slowed in recent years,[28] total withdrawals continue to exceed both natural and artificial recharge rates.[29]

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20. GNEB 13, *supra* note 1, at 3.

21. *Id.*; *see also supra* note 15 (discussing sister cities on the border).

22. *See* GNEB 13, *supra* note 1; *see also* JAMES GERBER, DEVELOPING THE U.S.-MEXICO BORDER REGION FOR A PROSPEROUS AND SECURE RELATIONSHIP: HUMAN AND PHYSICAL INFRASTRUCTURE ALONG THE U.S. BORDER WITH MEXICO, THE JAMES A. BAKER III INSTITUTE FOR PUBLIC POLICY OF RICE UNIVERSITY 6 (Mar. 27, 2009), *available at* http://www.bakerinstitute.org/files/documents/u.s.-mexico-border-project-binational-research-papers/LAI-pub-BorderSecGerber-032709.pdf (charting the population growths of U.S. counties and Mexican municipios along the entire border between 1980-2005 and showing that rates in some counties and municipios were double the respective national rates).

23. U.S. GEOLOGICAL SURVEY, GROUNDWATER WITHDRAWALS BY WATER-USE CATEGORY, 2005, IN MILLION GALLONS PER DAY, *available at* http://ga.water.usgs.gov/edu/wateruse/pdf/wugw-mgd-2005.pdf (last visited Jan. 28, 2013) (providing 2005 ground water withdrawal estimates for all fifty U.S. states). In 2012, groundwater accounted for sixty percent of all water used in Texas. *See* TEX. WATER DEV. BD., WATER FOR TEXAS 2012: STATE WATER PLAN 163 (2012).

24. Liverman, *supra* note 10, at 611.

25. *See* Garcia-Acevedo & Ingram, *supra* note 5, at 19 (noting that "Prior to 1940, groundwater basins in many border areas were in physical equilibrium . . . Since then, water withdrawal has far exceeded recharge and has degraded water quality").

26. Liverman, *supra* note 10, at 611.

27. *See* Bill Hume, *Water in the U.S.-Mexico Border Area*, 40 NAT. RESOURCES J. 189, 191 (2000); Octavio Chavez, *Mining of Internationally Shared Aquifers: The El Paso-Juirez Case*, 40 NAT. RESOURCES J. 237, 248 (2000).

28. Between 1995 and 2005, the water table of the Hueco Bolson aquifer in the Ciudad Juarez-El Paso region declined by an average of only seven feet annually. *See* RADU BOGHICI, TEX. WATER DEV. BD., REPORT 379: CHANGES IN WATER LEVELS IN TEXAS, 1995 TO 2005 43 (July 2011), *available at* http://www.twdb.state.tx.us/publications/reports/numbered_reports/doc/R379_WaterLevels.pdf.

29. In 2001, total withdrawals from the Hueco Bolson aquifer exceeded 312 million cubic meters (MCM), including 155 MCM by Ciudad Juarez and 62.2 MCM by El Paso (94.8 MCM was withdrawn by other municipalities and entities overlying the aquifer). In comparison, natural and artificial recharge amounted to a mere 9.6 MCM, while seepage from the Rio Grande added an additional 35.7 MCM. *See* Sheng & Devere,

Similar overdrafting can be found throughout the border, including in the Mexicali Valley where annual ground water withdrawals in the 1990s exceeded recharge by nearly two million acre-feet.[30]

In addition, lack of transboundary monitoring, coordination, and management has allowed the contamination and impairment of these critical resources. Aquifers all along the border are being degraded by leaking septic tanks, underground storage containers holding fuel products and other chemicals, agricultural run-off, industrial activities, intrusion from saline aquifers, and other pollution sources.[31] For example, in the Nogales, Sonora-Nogales, Arizona region, topographic conditions and a lack of infrastructure on the Sonoran side cause the majority of raw sewage and wastewater produced in Mexican *colonias* to flow downhill into Nogales, Arizona.[32] In Las Cruces, New Mexico, the U.S. Environmental Protection Agency designated a section of the city's well field in the transboundary Mesilla Bolson Aquifer as a Superfund site due to perchloroethylene contamination.[33] The source of the perchloroethylene, a volatile organic compound, has yet to be established.[34] Aquifers throughout the border region have been polluted by both naturally occurring and industrial sources of arsenic, as well as phosphates and nitrogen from agriculture run-off.[35] Moreover, heavy pumping of a number of the aquifers that traverse the border, including the Hueco

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supra note 14, at 816-17; U.S. ARMY CORPS OF ENG'R, ERDC/CERL TR-09-38, ARMY INSTALLATIONS WATER SUSTAINABILITY ASSESSMENT: AN EVALUATION TO VULNERABILITY OF WATER SUPPLY 107 (Sept. 2009), *available at* http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA525795&Location=U2&doc=GetTRDoc.pdf. The result is an average decline in water storage of approximately 18.4 million gallons per day. *Id.*

30. *See* Garcia-Acevedo & Ingram, *supra* note 5, at 19.

31. *See, e.g.,* Christopher Brown, *Transboundary Water Resource Issues on the US-Mexico Border: Challenges and Opportunities in the 21st Century*, VERTIGO, Sept. 2005 at 5, *available at* http://vertigo.revues.org/1883 (last visited Jan. 28, 2013); PAUL WESTERHOFF, ET.AL., PROJ. NO. W-03-19, DRINKING WATER QUALITY IN THE US-MEXICO BORDER REGION 5-7 (2004), *available at* http://www.scerpfiles.org/cont_mgt/doc_files/W-03-19-final.pdf; Suzanne Levesque & Helen Ingram, *Lessons in Transboundary Resource Management from Ambos Nogales*, 2 THE ECONOMICS OF NON-MARKET GOODS AND RESOURCES 161, 168 (2003); FAR WEST TEXAS WATER PLAN, *supra* note 14, at 1-47, 1-71.

32. Among other documented contaminants that have polluted area aquifers and surface waters are ammonia, heavy metals, fecal coliform, and Cryptosporidium. *See* Levesque & Ingram, *supra* note 32, at 168. Aquifer degradation, however, is also occurring on the U.S. side. In the U.S. state of New Mexico, between 1927 and 2000, the New Mexico Environment Department identified more than 1,400 cases of groundwater contamination originating from a variety of point and non-point sources, including domestic septic tanks and cesspools discharging around 94 million gallons of wastewater per day into the subsurface. *See* N.M. ENV'T DEP'T, THE STATE OF THE ENVIRONMENT: 2001 REPORT 26 (2001); Dennis McQuillan, et.al, *Ground Water: New Mexico's Buried Treasure*, N.M. ENV'T DEP'T 3 (May 2006).

33. *See generally,* U.S. EPA, RECORD OF DECISION, GRIGGS AND WALNUT GROUND WATER PLUME SUPERFUND SITE (June 2007) [hereinafter EPA], *available at* http://www.epa.gov/region6/6sf/newmexico/griggs/nm_griggs_rod.pdf. Perchloroethylene, also known as tetrachloroethene or tetrachloroethylene, is a chemical commonly used in dry cleaning. U.S. EPA, CHEMICALS IN THE ENVIRONMENT: PERCHLOROETHYLENE, CAS. NO. 127-18-4, OFFICE OF POLLUTION PREVENTION AND TOXICS FACT SHEET (Aug. 1994), *available at* http://www.epa.gov/chemfact/f_perchl.txt.

34. EPA, *supra* note 33.

35. WESTERHOFF, *supra* note 31.

Bolson, has allowed brackish water to migrate into the fresh zones of the aquifers thereby increasing the salinity of these ground water resources.[36]

C. FAILING TO AGREE

Presently, no comprehensive agreement exists between Mexico and the United States on the regulation, management, allocation, or protection of the aquifers that traverse the frontier. With one prominent exception, ground water resources are only cursorily referenced in a few bilateral instruments[37] and little evidence points to a more formal, comprehensive accord on the horizon.[38]

The only formal bilateral instrument between Mexico and the United States that directly refers to the region's transboundary aquifers is Minute 242[39] of 1973

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36. FAR WEST TEXAS WATER PLAN, *supra* note 14, at 1-47, 1-71.

37. Minute 289 of 1992, of the International Boundary and Water Commission (IBWC), addresses water quality problems along the Mexico-U.S. border. While the majority of the Minute focuses on the Rio Grande and Colorado rivers, Paragraph 4 refers to the Integrated Border Environmental Plan that was adopted by the two countries in the same year. In turn, that Plan calls for the creation of a water-monitoring program and database to observe both ground and surface water quality along the frontier. *See* INT'L BOUNDARY AND WATER COMM'N, MINUTE 289: OBSERVATION OF THE QUALITY OF THE WATERS ALONG THE UNITED STATES AND MEXICO BORDER, (Nov. 13, 1992), *available at* http://www.ibwc.gov/Files/Minutes/Min289.pdf. In addition, the Mexico-U.S. Agreement on Cooperation for the Protection and Improvement of the Environment in the Border Area (better known as the La Paz Agreement) was crafted to promote cooperation for environmental protection on the border. Although the agreement does not highlight ground water resources, it does obligate both parties to undertake a host of obligations related to the protection of all water resources on the border from pollution, cooperation over shared environmental issues, and coordination of efforts related to the border environment. *See* Agreement Between the United States of America and the United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area, arts. 2, 5-6, Aug. 14, 1983, 35 U.S.T. 2916, *available at* http://treaties.un.org/doc/Publication/UNTS/Volume%201352/volume-1352-I-22805-English.pdf. Presumably, these obligations encompass the region's transboundary aquifers. Moreover, Annex II to the treaty, relating to the discharge of hazardous substances along the inland international boundary between the two nations, does include ground water within the definition of "environment." *See* Annex II to the Agreement Between the United States of America and the United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area, Agreement of Cooperation Regarding Pollution of the Environment Along the Inland International Boundary by Discharges of Hazardous Substances, art. I(b), Jul. 18, 1985, 1990 WL 525899.

38. Carlos Marin, who served as Commissioner of the U.S. section of the IBWC from 2006-2008, asserted that even in the context of data development, "the states are apprehensive about allowing federal government involvement in the regulation of groundwater." *See* Carlos Marin, *Bi-National Border Water Supply Issues from the Perspective of the IBWC*, 11 U.S.-MEX. L.J. 35, 39 (2003); *Cf.* Stephen P. Mumme, *Advancing Binational Cooperation in Transboundary Aquifer Management on the U.S.-Mexico Border*, 16 COLO. J. INT'L ENVTL. L. & POL'Y 77, 89-90 (2005) (indicating that the "political-diplomatic reality" suggests that the U.S. section of the IBWC is unlikely to pursue a comprehensive transboundary aquifer agreement with its Mexican counterpart absent clear support from U.S. border state governments).

39. Agreement Confirming Minute No. 242 of the International Boundary and Water Commission, United States and Mexico, ¶ 5, Aug. 30, 1973, 24 U.S.T. 1968, 1973 WL 151875 [hereinafter Minute No. 242]. Minutes are decisions or recommendations of the IBWC, which, once approved by both governments, become binding obligations on the countries. The IBWC uses Minutes to implement its mandate and commitments. *See* Alberto Szekely, *How to Accommodate an Uncertain Future into Institutional Responsiveness and Planning: The Case of Mexico and the United States*, 33 NAT. RESOURCES J. 397, 398 (1993).

of the International Boundary and Water Commission (IBWC).[40] Although focused primarily on salinity levels in the Colorado River, Paragraph 5 of the Minute limits ground water withdrawals on both sides of the Sonora-Arizona border near San Luis, Arizona to specifically enumerated withdrawal targets.[41] In addition, Paragraph 6 mandates consultation prior to the development by either nation of any ground water resources along the border that could adversely impact the other country.[42]

The IBWC developed these two provisions because of American concerns over the southward migration of "American" ground water underneath the frontier in the border area near San Luis, Arizona. A decade prior to authorization of Minute 242, Mexico had installed a well field—the San Luis Mesa Well Field —just south of the border near San Luis that, through its pumping activities, caused ground water from the American side to flow southward under and across the border.[43] In order to minimize the "losses," the United States proposed these provisions and, following implementation of Minute 242, constructed a well field of its own on the U.S. side of the border. Thereafter, under agreement with Mexico, the United States delivered to Mexico the water they extracted on the U.S. side as part of its annual Colorado River water supply obligations under the 1944 Treaty.[44]

Significantly, the two ground water provisions of Minute 242 were intended as temporary measures "pending the conclusion . . . of a comprehensive agreement on groundwater in the border region."[45] Following adoption of the Minute, the American Section of the IBWC received authorization to pursue an accord with their Mexican counterparts. While the Section produced a number of alternative

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40. The IBWC is a binational commission whose current mandate was defined largely in *Treaty Between the United States of America and Mexico Relating to the Utilization of the Waters of the Colorado and Tijuana Rivers and of the Rio Grande*, 59 STAT. 1219 (1944).

41. Minute No. 242, *supra* note 39, at ¶ 5.

42. *Id.* at ¶ 6.

43. Mumme 1988, *supra* note 3, at 4. In fact, Mexico ground water activities in the San Luis area were in direct response to the activities of the Wellton Mohawk Irrigation District of Yuma County, Arizona, which in 1961, started pumping saline ground water into the Colorado River and charging the volume against Mexico's allotment under the 1944 Treaty. Because Mexico could not use the Colorado's now higher salinity water for its agricultural production, it started pumping ground water within Mexico just across the border from San Luis and Yuma, Arizona. That, in turn, spurred concern on the American side and eventually resulted in the development of Minute 242. *Id.*

44. *See* 59 STAT. 1219, at arts. 10-11; *Colorado River Basin Salinity Control Project—Protective and Regulatory Pumping Unit—Title I*, BUREAU OF RECLAMATION *http://www.usbr.gov/projects/Project.jsp?proj_Name=CRBSCP+-+Protective+and++Regulatory+Pumping+Unit+-+Title+I* (last updated Oct. 2, 2009). Under the 1944 Treaty, the U.S. is obligated to deliver an annual 1.5 million acre-feet of water in the Colorado River at the border. *See* 59 STAT. 1219, at art. 10. While somewhat obscured in the explanation, one of the chief purposes behind this formalization effort appears to have been the desire of various stakeholders on the Colorado River to reduce the amount of water that, per the 1944 Treaty, had to be left in the Colorado River for Mexico. By substituting the ground water pumped from the Arizona-Sonora border area for Colorado River water, more of the Colorado River could then be used within the U.S.

45. Minute No. 242, *supra* note 39, at ¶ 5.

schemes for apportionment and management of the border's transboundary aquifers, divisions among the various stakeholders, especially on the American side, made agreement impossible.[46] As a result, nearly four decades later, the temporary provisions of Minute 242 remain in place.[47]

III. CONSTRAINTS TO FORMAL BI-NATIONAL COOPERATION

Both Mexico and the United States readily acknowledge the importance of the region's ground water resources and the declining condition of these aquifers.[48] However, since implementation of Minute 242, neither nation has pursued any significant efforts to further or formalize their transboundary ground water relations. In fact, with few exceptions, Mexico and the United States have taken a unilateral approach to the management of the transboundary aquifers underlying their shared border.[49] Essentially, both nations have permitted landowners, companies, public entities, and others to construct wells all along the border and to withdraw ground water, within their respective territories, in response to the increasing needs of their individual citizens and economies. Moreover, they often allow these activities to continue with little regard for the impact on each other, on the border's transboundary aquifers, or on the region's environment. The consequences have been regrettable.

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46. *See* Robert J. McCarthy, *Executive Authority, Adaptive Treaty Interpretation, and the International Boundary and Water Commission, U.S.-Mexico*, 14 U. DENV. WATER L. REV. 197, 227-28 (2011) (describing the efforts by the US-IBWC to develop a ground water agreement following adoption of Minute 242).

47. As of December 2010, both Mexico and the United States continued to be in compliance with the pumping restrictions under Paragraph 5 of Minute 242. *See* EDWARD DRUSINA, INT'L BOUNDARY AND WATER COMM'N, A REPORT ON COLORADO RIVER SALINITY OPERATIONS, UNDER INT'L BOUNDARY AND WATER COMM'N MINUTE NO. 242 6, 8, 16, 17 (Sept. 2011), *available at* http://www.ibwc.state.gov/Files/Annual_Salinity_Report_2010.pdf.

48. In 2006, the United States Congress adopted the U.S.-Mexico Transboundary Aquifers Assessment Act in recognition of the need to systematically assess ground water resources along the border. *See* United States-Mexico Transboundary Aquifer Assessment Act, Pub. L. No. 109-448, 120 Stat. 3328-3332 (Dec. 22, 2006), [hereinafter TBA Act], *available at* http://internationalwaterlaw.org/documents/regionaldocs/Local-GW-Agreements/US-Mex_Aquifer-Assessement-Act.pdf. To date, the program has received $2,000,000 in funding from the fifty million dollars authorized by the U.S. Congress over its ten-year life span. *See* TAAP-A/S, FACT SHEET: U.S.-MEXICO TRANSBOUNDARY AQUIFER ASSESSMENT PROGRAM-ARIZONA (TAAP-A/S) (Mar. 7, 2011), *available at* https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/taap/pdf/factsheet.pdf.

In 2008, the Mexican government began exploring possibilities of negotiating a new clause in the *1944 Treaty*, *supra* note 40, with the United States to address the border region's ground water resources. *See* Charles Navarro, *Mexican Government Considers Adding Aquifers to 1944 Water Treaty*, 19 LATIN AM. DATABASE (2008). *See also* GNEB 13, *supra* note 1, at 28-29 (recognizing the importance of ground water resources to border communities and agriculture and identifying ground water contamination as an "immediate priority).

49. Enactment of the TBA Act, *supra* note 48, is but one example of American unilateralism. While the Act obligates the Secretary of the U.S. Department of the Interior "to develop partnerships with, and receive input from, relevant organizations in Mexico to carry out the program," it is not authorized or funded as a bilateral project. *See* TBA Act, *supra* note 48, at §§ 4-5. Notwithstanding, in the vast majority of cases, the U.S. has left aquifer management and withdrawal regulation to the four U.S. border-states. *See infra* notes 64-80, and accompanying text.

Why have Mexico and the United States not entered into an agreement for the management of their shared ground water resources? Why have they neglected to raise the issue in formal diplomatic efforts with each other? Why has Minute 242's laudable objective for a forthcoming "comprehensive" ground water agreement for the border region[50] remained unfulfilled? Some scholars suggest a simple case of "out of sight, out of mind" whereby the hidden nature of ground water resources results in their being ignored by politicians and the general public.[51] Others offer a more nefarious explanation, suggesting that the United States, as the hegemon in the Mexico-U.S. relationship, prefers to maintain the status quo and manage the resource unilaterally in its own best interests.[52]

Finally, an equally complicated, but possibly more pragmatic, perspective submits that the domestic legal and political systems of both Mexico and the United States, as they relate to the management of ground water resources, make formal cooperation and coordination unwieldy and possibly unattainable.[53] This is especially evident in the disparate domestic laws of both nations, which quite effectively impede the achievement of a formal bilateral treaty for the administration of aquifers traversing the border. In addition, the dearth of adequate and compatible data and information on the region's ground water resources may make cooperation a near-futile effort.

A. GROUND WATER LAWS ON THE BORDER

Both Mexico and the United States operate as federations of states allowing their respective member states to enjoy substantial self-governance. The region contains ten state governments—six Mexican[54] and four U.S.[55]—that are directly involved in issues affecting the border. While under international law the domestic laws of subnational governmental units cannot control international transboundary relations, each state's laws nevertheless can have considerable consequences on the development of cross-border interactions. To varying

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50. Minute No. 242, *supra* note 39, at ¶ 6.

51. *See e.g.* Ludwik A. Teclaff & Eileen Teclaff, *Transboundary Ground Water Pollution: Survey and Trends in Treaty Law*, *in* INTERNAT'L GROUNDWATER L. 77, 110 (Ludwik A. Teclaff & Albert E. Utton eds., 1981).

52. *See* Mumme 2000, *supra* note 19, at 347. Building on this theme, Garcia-Acevedo and Ingram suggest that "[t]he enormous asymmetry of power between the United States and Mexico" prevents achievement of mutual interests and reasonable trust, conditions necessary for any agreement. Since Mexico has little leverage against the United States, the hegemon prefers to pursue cooperation on its own terms and only when needed. *See* Garcia-Acevedo & Ingram, *supra* note 5, at 24.

53. *See* Evans, *supra* note 3, at 479; *See* Gabriel E. Eckstein, *Buried Treasure or Buried Hope? The Status of Mexico-U.S. Transboundary Aquifers under International Law*, 13 INT'L COMMUNITY L.R. 273, 277-284 (2011) [hereinafter Eckstein, *Buried Treasure or Buried Hope?*].

54. The six Mexican border-states include: Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas.

55. The four U.S. border-states include: California, Arizona, New Mexico, and Texas.

extents, the procedural and substantive regulations of subnational jurisdictions place serious constraints on the ability of their national governments to enter into arrangements with or make commitments to neighboring nations.

1. Water Law in Mexico

The Mexican national constitution explicitly reserves authority to regulate all aspects of surface and ground water resources to the federal government.[56] The Comisión Nacional del Agua (better known by its acronym "CONAGUA") exercises this authority by subjecting all water users to a regulated permitting process. While six Mexican states border the United States, national legislation preserves federal control and oversight over fresh water resources and provides some standardization in water regulations across the country.[57]

Notwithstanding federal control, the past two decades have seen legislation and delegation assigning various administrative responsibilities for fresh water resources management to numerous state and local institutions in a less than systematic manner.[58] Moreover, lack of competence and clarity in this decentral-

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56. Article 27 of the Mexican Constitution clearly establishes that "[t]he Nation has an original right of property over the lands and waters within the boundaries of the national territory. The Nation has and will have the right to transfer its property's domain to private individuals in order to create private property rights." Constitución Política de los Estados Unidos Mexicanos [C.P.], *as amended*, art. 27, Diario Oficial de la Federación [DO], 5 de Febrero de 1917 (Mex.), *translation available at* http://www.juridicas.unam.mx/infjur/leg/constmex/pdf/consting.pdf (last visited Jan. 28, 2013). The right of private ownership, however, is limited by the federal government to the extent that:

> The Nation shall have at all times the right to impose on private property restrictions based on public interest considerations as well as to regulate, for the society's benefit, the full employment of available commodities. This shall be done in order to achieve a fairer distribution wealth while preserving it, as well as to achieve a balanced national development and improve the living standards of both rural and urban populations.

Id. Article 27 further provides that:

> Underground waters can be freely brought to the surface by technological devices and, therefore, the owner of the land may claim them; yet under public interest considerations or whenever some other uses of the water were affected, the Executive Branch of Federal Government will be empowered not only to regulate such waters extraction and use but also to restrain the access to them as it can do with respect to the rest of national waters.

Id.

57. *See* COMM'N ON ENVTL. COOPERATION, N. AM. ENVTL. LAW & POLICY, NORTH AMERICAN BOUNDARY AND TRANSBOUNDARY INLAND WATER MANAGEMENT REPORT 28 (2001), *available at* http://www.cec.org/Storage/45/3790_NAELP7e.pdf [hereinafter COMM'N ON ENVTL. COOPERATION] (stating that "the administration of water resources in Mexico is still dominated by the federal government and is highly centralized"). *See also generally* Ley de Aguas Nacionales, [National Water Law], as amended, Diario Oficial de la Federación [DO], 1 de diciembre de 1992, (Mex.), *available at* http://www.diputados.gob.mx/LeyesBiblio/pdf/16.pdf (last visited Jan. 28, 2013).

58. *See* COMM'N ON ENVTL. COOPERATION, *supra* note 57, at 29-30 (discussing the decentralization and delegation effort instituted in the early 1990s); Anita Milman & Christopher A. Scott, *Beneath the surface: intranational institutions and management of the United States-Mexico transboundary Santa Cruz aquifer*, 28 ENV'T & PLANNING C: GOV'T & POL'Y 528, 541-44 (2010); Gavrell, *supra* note 3, at 211-12.

ization effort has led to ambiguities in authority and overlapping jurisdiction.[59] For example, both CONAGUA and the Mexican Section of the IBWC maintain jurisdiction over transboundary ground water resources located inside Mexico. While CONAGUA holds responsibility for general water resources administration and focuses its efforts on the needs of Mexico's domestic water needs, the Mexican Section of the IBWC is tasked with diplomatic relations related to transboundary waters.[60] As a result, Mexico's ability to manage and negotiate over transboundary aspects of its ground water resources is contingent on the ability of the two Mexican agencies to coordinate their efforts in light of their disparate functions.

2. Water Law in the United States

While the Mexican system for managing fresh water resources complicates negotiation with the United States, the scope and complexity of that system pales in comparison to the U.S. system. The U.S. federal structure has largely devolved the allocation and management of fresh water resources to the states. Although federal environmental laws like the Clean Water Act[61] and Safe Drinking Water Act[62] have taken over water quality issues from the states, the quantity allocation and management of fresh water resources fall within the near exclusive purview of each individual state.[63] This authority includes the determination and distribution of water rights.[64]

As articulated by the Supreme Court of the United States, "[t]he history of the relationship between the Federal Government and the States in the reclamation of the arid lands of the Western States is both long and involved, but through it runs the consistent thread of purposeful and continued deference to state water law by Congress."[65] This deference to the states has allowed them to develop individual state interests and priorities, which all too often conflict with those of neighboring states as well as of the federal government. Moreover, as it pertains to the four U.S. states that border Mexico, deference has allowed implementation of four

59. *See* Milman & Scott, *supra* note 58, at 541-44.

60. *See id.*; *see also* Gavrell, *supra* note 3, at 212 (noting that CONAGUA "has generally neglected to manage groundwater along the border, and this is reflected in the scarcity of protected zones and the substantial problems regionally with overdrafts and water quality").

61. 33 U.S.C. §§ 1251-1387 (2006).

62. 42 U.S.C. § 300f-j (2006).

63. One of the exceptions to state control over water quantity issues relates to out-of-state water exports. In *Sporhase v. Nebraska*, the U.S. Supreme Court held that because water is an article of commerce, states may not impose restrictions on the export of water unless justified on grounds of water conservation and public welfare. 458 US 941, 952-57 (1982).

64. Robert H. Abrams, *Secure Water Rights in Interstate Waters*, *in* WATER LAW: TRENDS, POLICY AND PRACTICE 330, 330 (Kathleen Marion Carr & James D. Crammond eds., 1995).

65. California v. United States, 438 U.S. 645, 653 (1978).

disparate sets of laws for ground water management.[66]

Texas, for example, follows the so-called "Rule of Capture," which entitles landowners to withdraw ground water from beneath their land regardless of the impact their pumping may have on neighboring landowners or other hydraulically related waters.[67] Liability may only lie where extraction 1) is intended to harm a neighboring landowner, 2) results in the waste of water, or 3) negligently causes subsidence of neighboring properties.[68] Texas courts, however, have interpreted the Rule of Capture liberally and have rarely found a violation of the Rule.

In contrast to Texas, the neighboring state of New Mexico owns its ground water on behalf of its citizens and allocates it according to the prior appropriation doctrine.[69] Under this system, the state considers ground water use a privilege rather than an absolute property right. The state engineer issues permits allocating water use that are enforced in accordance with the principle of "first in time, first in right"—in times of drought or other water scarce conditions, users with more senior (older) permits have a right to their full allocation before those with junior (younger) permits can enjoy their allotment.[70] Although prior appropriation restricts ground water use to beneficial purposes, New Mexico courts have interpreted broadly what uses are considered beneficial.

Arizona applies the doctrine of reasonable use to ground water management and allocation. Under this scheme, landowners may pump underlying ground water for reasonable uses on overlying land. The reasonableness of a particular use is assessed based on a totality of circumstances and considers such factors as well location, the amount of water used, the purpose of the use, the placement of the water, and the extent to which the use may be wasteful.[71] Where water is inadequate for two reasonable uses, the courts have tended to reduce the allocations of the users on a pro rata basis. The use of ground water on non-overlying land, however, is permitted only where it does not damage or impair the water supply of another landowner who is making reasonable use on land overlying the same ground water basin.[72] Ground water withdrawal is also constrained where it tends to diminish the flow of a surface stream appreciably and directly.[73] In addition, Arizona has created Groundwater Management Areas

66. *See* Eckstein, *Buried Treasure or Buried Hope?*, *supra* note 53, at 282-83.

67. Edwards Aquifer Auth. v. Day, 369 S.W.3d 814, 827 (Tex. 2012). In the *Day* case, the Texas Supreme Court concluded that a landowner has a real property interest in the underlying ground water in place, analogous to a landowner's property interest in underlying oil and gas deposits. *Id.*

68. *See* Sipriano v. Great Spring Waters of Am., Inc., 1 S.W.3d 75, 83 (Tex. 1999).

69. N.M. CONST. art. XVI, § 2; State ex rel. Erickson v. McLean, 308 P.2d 983 (N.M. 1957).

70. N.M. STAT. ANN. § 72-12-1.1 (2012); *State ex rel. Erickson*, 308 P.2d at 983.

71. Bristor v. Cheatham, 75 Ariz. 227, 236-38 (1953).

72. Neal v. Hunt, 541 P.2d 559, 565-66 (Ariz. 1975).

73. In re the General Adjudication of All Rights to Use Water in the Gila River System and Source, 989 P.2d 739, 743 (Ariz. 1999) (*en banc*).

in which a variety of additional local ground water use restrictions are implemented in relation to both water needs and availability.[74]

Of the four U.S. states, California may have the most confounding series of rules for ground water resources since the state employs two legal schemes—prior appropriation and correlative rights—for managing its ground water resources. Under correlative rights, landowners overlying an aquifer have an equal right to a "fair and just proportion" of the underlying water for reasonable beneficial uses on their overlying land. California courts have liberally interpreted the notions of fairness, reasonableness, and beneficial use. In times of shortage, each correlative overlying user may use only a reasonable amount.[75] In contrast, groundwater users who use the water on non-overlying land are considered appropriators much like prior appropriators in New Mexico. As between two appropriators, the rule of "first in time, first in right" applies.[76] Where an appropriator's use conflicts with that of an overlying user applying the water on overlying land, the latter's rights are absolutely superior to those of the former.[77]

To further complicate the picture, a number of these states have created local ground water districts with the authority to formulate and implement their own local rules and standards. Texas, for example, has afforded such districts regulatory authority to impose well-spacing controls, withdrawal limitations, and other restrictions.[78] Because the authorizing legislation has been general, there is little standardization among the various districts' rules in the implementation of these restrictions.

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74. Kevin L. Patrick & Kelly E. Archer, *A Comparison of State Groundwater Laws*, 30 TULSA L.J. 123, 133-35 (1994).

75. *See* Katz v. Walkinshaw, 74 P. 766, 771 (Cal. 1903) (introducing the correlative rights doctrine in California); Kelley J. Hart, *The Mojave Desert as Grounds for Change: Clarifying Property Rights in California's Groundwater to Make Extraction Sustainable Statewide*, 14 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 1213, 1220 (2008).

76. *See* Hart, *supra* note 75, at 1220.

77. Jason M. Miller, *When Equity is Unfair—Upholding Long-Standing Principles of California Water Law in City of Barstow v. Mojave Water Agency*, 32 MCGEORGE L. REV. 991, 994-95 (2001); G. BRYNER AND E. PURCELL, GROUNDWATER LAW SOURCEBOOK OF THE WESTERN UNITED STATES, NATURAL RES. LAW CTR, UNIV. OF COLO. AT BOULDER 14 (2003).

78. TEX. WATER CODE ANN. § 36.101(a) (West 2011). *See also* Tex. Comm'n on Envtl. Quality, *Summary Description of GCDs* (July 2010), *available at* http://www.tceq.state.tx.us/assets/public/permitting/watersupply/groundwater/maps/gcd_text.pdf (last visited Jan. 28, 2013). Of the 96 confirmed ground water conservation districts in Texas, five share a border with Mexico. Those districts are found within the county boundaries of Brewster, Jeff Davis Kinney, Presidio, and Starr counties. *See also* Map: Groundwater Conservation Districts, Texas Water Development Board (September 2010), *available at* http://www.twdb.state.tx.us/mapping/doc/maps/gcd_only_8x11.pdf (last updated Jan. 2013).

Due to a recent Texas Supreme Court decision concluding that Texas landowners have a property right in their groundwater, governmental restraints on withdrawals could result in a constitutionally unlawful taking of private property. *See* Edwards Aquifer Auth. v. Day, 369 S.W.3d 814, 831-32 (Tex. 2012). The decision will likely strengthen the ground water rights of individual private landowners at the expense of Texas ground water districts, as well as the interests of the state and the general public.

The multitude of state and local authorities involved in regulating ground water resources in the United States has severely constrained the ability of the federal government to present a unified American national position on the management of transboundary ground water resources along the Mexico-U.S. border.[79] Any negotiation undertaken by the United States must take into account the multiplicity of interests, stakeholders, policies, and laws of the various political subunits and, most likely, include representatives of those subunits in deliberations. As lamented by the Good Neighbor Environmental Board (GNEB), albeit in a politically understated tone, "Coordination on shared aquifers is difficult because groundwater is controlled by state governments in the United States and the federal government in Mexico."[80]

B. THE DATA GAP

As noted above, there exists an acute deficiency in the availability of reliable, relevant, and congruent information on the various ground water resources traversing the Mexico-U.S. border.[81] While some of the aquifers have been studied and characterized—most famously the Hueco Bolson underlying Ciudad Juarez and El Paso[82]—the extent of information about the region's remaining aquifers is scant and dispersed.[83] The absence of relevant and accurate information severely constrains the ability of managers and decision-makers to formulate strategies and policies for the sustainable management of the region's aquifers, protect or mitigate against deleterious consequences that might result from their use, and negotiate with relevant stakeholders, on both sides of the border, to

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79. *See* Hume, *supra* note 28 at 190 (2000) (noting that the interests of the individual border states, as well as those of political subunits and individual users, may conflict with those of the federal government); *see also* COMM'N ON ENVTL. COOPERATION, *supra* note 59, at 141 (noting that "[c]urrently, there is no institutional mechanism for coordinating the disparate national, state and local interests in matters involving domestic transboundary waters").

80. GNEB 13, *supra* note 1, at 31.

81. *See e.g.*, The World Bank, Rep. No. 15435-ME, Staff Appraisal Report: Mexico Water Resources Management Program 12, Annex. C, tbl. C-3 (May 31, 1996), *available at* http://www.bvsde.paho.org/bvsarg/i/fulltext/staff/staff.pdf (noting deficiencies in adequate monitoring systems, lack of quantitative studies and mathematical models for numerous aquifers, absence of a repository or processing system for ground water data and information, and other deficits). *See also supra* note 19 and accompanying text.

Information relevant to the development of a sound understanding of each transboundary aquifer includes data, *inter alia*, on each aquifer's geographic range, volume, flow, chemistry, recharge, functioning, and dependent ecosystems. *See* G.A. Res. 63/124, art. 8, ¶ 1, U.N. Doc. A/RES/63/124 (15 January 2009) [hereinafter Res. 63/124] (mandating exchange of information "of a geological, hydrogeological, hydrological, meteorological and ecological nature and related to the hydrochemistry of the aquifer or aquifer system, as well as related forecasts").

82. *See e.g.*, INT'L BOUNDARY & WATER COMM'N, TRANSBOUNDARY AQUIFERS AND BINATIONAL GROUND WATER DATABASE FOR THE CITY OF EL PASO/CIUDAD JUÁREZ AREA (1998), *available at* http://www.ibwc.gov/Water_Data/binational_waters.htm (last visited Jan. 28, 2013) [hereinafter TRANSBOUNDARY AQUIFERS].

83. *Cf.* COMM'N ON ENVTL. COOPERATION, *supra* note 58, at 141 (lamenting the overall lack of information on and assessment of ground water resources in the United States).

coordinate such efforts.[84]

Moreover, and equally as important, there remains a lack of coordination in the generation of data and information. Unfortunately, many of the studies prepared to date have been conducted independently on either side of the frontier, use disparate scientific standards, collect dissimilar data, and generate maps and conceptual models that "end" at the border.[85] As described by the GNEB, researchers and water managers

> "often are faced with the 'blank map' syndrome in which a transboundary aquifer is mapped by an entity in the United States but, because the U.S. researcher lacks access to Mexican data, the portion of the aquifer south of the border shows up completely blank on the map (the same problem occurs north of the border for the Mexican researcher)."[86]

In addition, Mexico and the United States have yet to formulate a consensus on methodologies, techniques, procedures, assumptions, and technologies—collectively known as metadata[87]—to use in the generation and processing of data and information.[88] This lack of consensus also poses a significant barrier to cooperation because incompatible data generated on different segments of an aquifer may be useless for establishing baseline aquifer characteristics or monitoring and assessing subsequent changes.[89] At the very least, this hampers the ability of decision-makers to fully project and plan for future needs and uses, as well as to protect against potential harms; at worst, this thwarts decision-makers' efforts.

IV. TRANSBOUNDARY GROUND WATER COOPERATION ON THE MEXICO-U.S. BORDER: THE WAY FORWARD

Scholars and other professionals have long championed pursuit of a formal bilateral treaty to manage the transboundary aquifers on the Mexico-U.S.

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84. *See* Gabriel Eckstein, *Commentary on the U.N. International Law Commission's Draft Articles on the Law of Transboundary Aquifers*, 18 COLO. J. INT'L ENVT'L L. & POL'Y 537, 578-79 (2007) [hereinafter Eckstein, *Commentary*].

85. Sheng & Devere, *supra* note 14, at 818-819.

86. GNEB 13, *supra* note 1, at 31.

87. According to the U.S. Geological Survey (USGS), "[m]etadata consists of information that characterizes data. Metadata are used to provide documentation for data products. In essence, metadata answer **who**, **what**, **when**, **where**, **why**, and **how** about every facet of the data that are being documented." U.S. GEOLOGICAL SURVEY, http://geology.usgs.gov/tools/metadata/tools/doc/faq.html#q1.1 (emphasis in original) (last updated Dec. 11, 2012).

88. Scientists often have available to them multiple approaches or instrumentations to assess a particular aquifer characteristic, such as rate of flow, hydraulic potential, or chemical composition. Different approaches, however, can produce disparate results because of the multitude of factors and assumptions that go into the analytical process of each approach. Moreover, due to variations in education, training, experience, and preferences, the professionals employed to conduct studies and produce data on a transboundary aquifer will often use different methodologies and procedures and may focus on different aquifer characteristics. Eckstein, *Commentary*, *supra* note 84, at 581-82.

89. Eckstein, *Commentary*, *supra* note 84, at 581-82.

frontier.[90] Given the numerous obstacles discussed herein, the likelihood of such a border-wide agreement is close to nil. Nevertheless, given the threat posed by diminishing ground water resources to the viability of the region's communities, natural environment, and economic growth, inaction is a recipe for disaster. Something must be done.

In order to surmount the numerous impediments obstructing a border-wide agreement, a new approach is needed—a new paradigm for administering transboundary ground water resources along the Mexico-U.S. border. In a prior study, the present author and a colleague identified an interesting phenomenon whereby subnational governmental units had sidestepped their federal counterparts and pursued cross-border cooperation on regional and local levels.[91] While not ubiquitous, these occurrences are noteworthy, especially to the extent that the arrangements provide examples of practical and seemingly successful processes for cooperation across international frontiers. Although the success of these arrangements is difficult to assess and the status of some of these arrangements may be legally indefensible,[92] empowering local institutions and communities to formulate locally-relevant, hydrologically appropriate, cross-border pacts possesses many positive traits.

A. BY LOCALS, FOR LOCALS

The degree of interest that the national authorities have in a local issue is often directly proportional to the physical distance from the capitol. In fact, priorities in specific areas of the border often conflict with those of the rest of the nation or of those espoused by the national legislature or executive office.[93] Hence, a disconnect often exists between knowledge and potential consequences when national officials address, or even neglect, a transboundary issue with regional or local significance.

While it focused on the European context, a report from 1973 on overcoming barriers to cooperation by local and regional authorities rightly noted the handicaps faced by local authorities in frontier areas as compared to their more centrally located counterparts. These problems typically arise because they are: a) geographically far from regional or national centers, b) reliant on their foreign

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90. *See supra* note 3 and accompanying text.

91. *See* Gabriel Eckstein & Amy Hardberger, *State Practice in the Management and Allocation of Transboundary Groundwater Resources in North America*, 18 YEARBOOK OF INT'L ENVTL. L. 96 (2008).

92. *See infra* notes 123-129, and accompanying text.

93. One of the clearest examples in the United States in which local opinion's often diverged from those of elected national representatives is in the area of immigration. For example, while many in the U.S. Congress have long championed construction of a fence along the Mexico-U.S. border as a means of preventing illegal immigration, numerous border communities vehemently oppose such projects. *See, e.g.*, *Texas Mayors Oppose Plan for Border Fence*, NAT'L PUB. RADIO (Oct. 16, 2007), http://www.npr.org/templates/story/story.php?storyId=15315131; *Texas cities oppose border fence*, THE WASH. TIMES, Feb. 21, 2008, http://www.washingtontimes.com/news/2008/feb/21/texas-cities-oppose-border-fence/?page=all.

neighbors for much of their commerce and trading, and c) have to work with authorities that, while only a short distance away, are located across an international political boundary.[94] The same situations and disadvantages are present today on the Mexico-U.S. border.

Efforts to achieve a thoughtful, environmentally-sound, and equitable management and allocation regime for a particular transboundary aquifer are more likely to succeed if they involve and are driven by local stakeholders and decision-makers.[95] While it may be true that local institutions and communities do not always have the resources or technical knowledge to address broad and scientifically complex cross-border challenges, this does not mean that they do not have the capacity to adopt and implement sound policies and arrangements based upon relevant studies and information obtained from higher-level governmental agencies or other sources.[96] In fact, local decision-makers are typically better informed about local and regional cross-border concerns than federal bureaucrats, especially on issues related to the management of area fresh water resources, and therefore are more likely to achieve an accord.[97] Moreover, local authorities are better able to reflect the values and preferences of those most likely to be affected by an accord with a neighboring country, which, for a local border community, is merely a short drive away.[98]

In addition, local decision-making would likely be more responsive and adaptable to changing circumstances and improved knowledge. Climate change, for example, threatens the border region in ways that have yet to be fully ascertained. While studies generally forecast more arid conditions and reduced rainfall and stream flow throughout the Mexico-U.S. border area in coming decades, much debate and speculation remains as to how, where, and to what extent those changes will occur. Moreover, and more to the point, impacts will likely vary all along the frontier, affecting different regions in disparate ways.[99]

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94. PAUL ORIANNE, DIFFICULTIES IN COOPERATION BETWEEN AUTHORITIES AND WAYS OF SOLVING THEM, LOCAL AND REGIONAL AUTHORITIES IN EUROPE STUDY NO. 6, COUNCIL OF EUROPE 4 (1973).

95. James L. Huffman, *Making Environmental Regulation More Adaptive Through Decentralization: The Case For Subsidiarity*, 52 U. KAN. L. REV. 1377-78, 1381-1382 (2004). In the European context, the emphasis on local decision-making is known as *subsidiarity*, a legal norm that obligates decision-making to be implemented at the lowest level of competent authority. *See* R.K. Vischer, *Subsidiarity as a Principle of Governance: Beyond Devolution*, 35 IND. L. REV. 103, 142 (2001); Paolo G. Carozza, *Subsidiarity as a Structural Principle of International Human Rights Law*, 97 AM. J. INT'L L. 38, 42 (2003).

96. *See* Huffman, *supra* note 95, at 1395.

97. *See* Patrick Forest, *Transferring bulk water between Canada and the United States: More than a century of transboundary inter-local water supplies*, 43 GEOFORUM 14, 17 (2012) (asserting that "[f] or these communities, water was more than just a symbol of cooperation; it was vital to their survival and economic well-being").

98. *Id.* at 16 (discussing the "bottom-up process based on local knowledge and understanding" that was used to achieve numerous local, cross-border water arrangements along the Canada-U.S. border).

99. *See generally* GLOBAL CLIMATE CHANGE IMPACTS IN THE US, A STATE OF KNOWLEDGE REPORT FROM THE US GLOBAL CHANGE RESEARCH PROGRAM 43-45 (Thomas R. Karl, Jerry M. Melillo & Thomas C. Peterson, eds., 2009), *available at* http://www.globalchange.gov/what-we-do/assessment/previous-assessments/global-climate-

While comprehensive, border-wide responses to climate variability may be suitable for certain aquifers and regions, local communities could be far more agile in formulating local responses and solutions to their unique circumstances as climatic and related changes become apparent.

Furthermore, the efficacy of local participation and decision-making is bolstered by the conviction that communities and citizens are best served by decisions made by those with the greatest stake in the subject matter and who would be most directly affected by possible outcomes.[100] Local border communities and their representatives typically have strong ties to individuals and groups on the other side of the frontier in the form of friendships, family relations, colleagues, and business connections. For decades, these communities have developed diverse and intense networks for collaborating on a wide variety of social (weddings and festivals), economic (trade and investment), public health and safety (fighting fires and criminal activity), academic (conferences and researcher collaborations), sporting (tournament and infrastructure), and other interests.[101] These bonds allow local individuals and groups to be flexible and adaptable to, as well as accepting of, unique local practices and changing conditions that national officials may not recognize or appreciate in the context of a negotiation. Moreover, locals have an especially strong incentive to seek out long-term solutions for cross-border challenges that are both practical and sustainable since they will have to live with the consequences of these decisions.[102]

In areas like the Mexico-U.S. frontier, where transboundary aquifers are the lifeblood of nearly every border village and population, discussions and decisions

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change-impacts-in-the-us-2009 (last visited Jan. 28, 2013) (providing maps showing increasing and decreasing trends, throughout the United States, in droughts between 1958-2007, variations in the number of days with heavy precipitation between 1958–2007, projected changes in annual runoff for 2041-2060); Victor O. Magaña and Cecilia Conde, *Climate Variability and Climate Change, and their Impacts on Freshwater Resources in the Border Region: A Case Study for Sonora, Mexico*, *in* CLIMATE AND WATER: TRANSBOUNDARY CHALLENGES IN THE AMERICAS 373 (Henry F. Diaz & Barbara J. Morehouse eds., 2003).

100. *See* Huffman, *supra* note 95, at 1378, 1381-1382 (recognizing that "[t]he principle of subsidiarity thus reflects a presumption in favor of decentralization but does not insist that centralization if never appropriate").

101. *See* HELEN INGRAM, ET AL., DIVIDED WATERS: BRIDGING THE U.S.-MEXICO BORDER 46-47 (1995) (discussing the border culture and the shared "we" feeling that marks border populations on the Mexico-U.S. border, as well as the informal cross-border networks that border residents create to deal with individual and community issues); *Cf.* Patrick Forest, *Inter-local water agreements: law, geography, and NAFTA*, 51 LES CAHIERS DE DROIT 749, 753-54 (2010) (discussing the close local relations on the Canada-U.S. border that have led to the development of locally-arranged transboundary freshwater transfers).

102. *Cf.* Maria Carmen Lemos & Arun Agrawal, *Environmental Governance*, 31 ANN. REV. OF ENV'T & RESOURCE. 297, 303 (2006) (asserting that decentralization of environmental governance "can produce greater efficiencies because of competition among subnational units; it can bring decision making closer to those affected by governance, thereby promoting higher participation and accountability; and finally, it can help decision makers take advantage of more precise time- and place-specific knowledge about natural resources"); Emma Spenner Norman & Jean O. Melious, *Hidden Waters: The Role of Local Communities in Transboundary Environmental Management Across the Forty-Ninth Parallel*, *in* TRANSBOUNDARY POLICY CHALLENGES IN THE PACIFIC BORDER REGIONS OF NORTH AMERICA 195, 202, 207, 212-13 (J. Loucky, et al., eds. 2008).

over the management of these resources are critically consequential for every citizen. Nevertheless, while the border physically divides many of the sister communities, residents on both sides often perceive themselves as one large community, providing a fertile opportunity for local, cross-border cooperation.[103]

This local, "bottom-up" approach to ground water management, however, is not intended as a broad panacea for every transboundary aquifer scenario and may not be appropriate in all circumstances. Factors and characteristics, such as the geographic scale of a cross-border aquifer, may dictate the level of administrative authority necessary to respond to particular issues and challenges posed.[104] Hence, for example, where an aquifer or aquifer basin extends over a limited region, local participation and decision-making may suffice. However, where the specific water challenge involves an aquifer or aquifer basin that transects or impacts a much larger area—for example, an aquifer hydraulically linked to a large domestic or transboundary river like the Rio Grande—a strictly local arrangement may be less suitable or effective. Decision-making ought to be handled by the lowest level of administrative authority with competence over the resource and its implications.[105]

Along the Mexico-U.S. border, some evidence shows that a local approach to the management of the region's transboundary waters is already underway. One notable example is the 1999 Memorandum of Understanding between the Municipal Water and Sanitation Board of the City of Juárez (in Chihuahua, Mexico) and the El Paso Water Utilities Public Service Board of the City of El Paso (in Texas, US) (MoU).[106] Although legally unofficial and unenforceable,[107]

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103. "Boundary cities have become so functionally intertwined that their futures are inextricably bound, whether the two national governments are able to or unable to devise formal procedures for addressing border related problems." LAWRENCE HERZOG, WHERE NORTH MEETS SOUTH: CITIES, SPACE, AND POLITICS ON THE U.S.-MEXICO BORDER 90 (1990). The sister cities of Ciudad Juarez (Chihuahua) and El Paso (Texas) have been described as having been "isolated from the rest of their respective countries and have depended greatly upon each other for social and economic activities." Ham-Chande & Weeks, *supra* note 8, at 11. Nuevo Laredo (Tamaulipas) and Laredo (Texas) are likewise inextricably bound because of their shared history. Nuevo Laredo was founded by former Laredo residents whose allegiances to Mexico pulled them across the Rio Grande following demarcation of the river as the official boundary between the two nations. "Because of this history, the ancestry and present family relationships across the bridge are very strong . . ." *Id.*

104. *See id.* at 1381 (asserting that "Only where the lower bodies prove ineffective should the federal government become involved").

105. *See* Vischer, *supra* note 95, at 142; Carozza, *supra* note 95, at 42. In some cases, multiple communities may overlay the aquifer on both sides of the border, in which case there may not be an established administrative authority at the most appropriate governance level. In such circumstances, it may be prudent for the communities on each side to band together to form an appropriate authority.

106. Memorandum of Understanding between City of Juárez, Mexico Utilities and the El Paso Water Utilities Public Services Board (PSP) of the City of El Paso, Texas (Dec. 6, 1999) [hereinafter MoU], *available at* http://www.internationalwaterlaw.org/documents/regionaldocs/Local-GW-Agreements/El_Paso-Juarez_MoU.pdf.

107. Subnational transboundary arrangements cannot create binding obligations for their parent nations because they do not have the imprimatur of the respective national governments. In practical terms, though, these unofficial pacts can have profound implications for the development of customary international law, at the

the MoU evidences the interests of governmental authorities on both sides of the international boundary, at the very local, sub-city level, to cooperate over and exchange information about a regionally-specific shared aquifer. Focusing on the Hueco Bolson Aquifer underlying the two cities and the hydraulically-linked Rio Grande, the two boards endorsed the MoU to "identify the mechanisms between the parties to increase communications, cooperation, and implementation of transboundary projects of common interest."[108]

Anecdotal evidence indicates that similar, albeit even less formal or publicized, cooperative arrangements over fresh water resources have been forged elsewhere along the border. For example, in 2002, a serious drought along the Arizona-Sonora border greatly depleted the region's aquifers and dried up numerous wells on both sides of the frontier. While communities all along the border suffered from this predicament, Mexican communities were especially hard-hit due to inadequate infrastructure and planning. As a means of assisting their parched brethren across the border, Nogales, Arizona agreed to temporarily deliver water to their sister city of Nogales, Sonora. A fire hose attached to a metered hydrant in Nogales, Arizona was draped across the border fence where Mexican tanker trucks filled up their tanks and then delivered water throughout Nogales, Sonora.[109] Apparently, this was not the first time that a temporary water transfer of this type had occurred.[110] While only a temporary measure, it serves as an example of local decision-makers taking responsibility for locally-specific, transboundary water issues and achieving locally-relevant solutions.

In one other fascinating example of a subnational cross-border water arrangement, a number of Nogales, Sonora businesses and private residences have, for the past half-century, obtained their water from the public water authority of Nogales, Arizona.[111] Located near the border, each of the water users receives its

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very least, as between the nations whose subnational entities entered into the arrangement. *See generally* Eckstein & Hardberger, *supra* note 91 at 97-98, 123-24 (noting that the existence of subnational transboundary aquifer arrangements in North America may be evidence of emerging state practice for purposes of identifying customary international norms).

108. MoU, *supra* note 106, at 3. The general objectives of the MoU include, *inter alia*: sharing data and information on historical and current withdrawals, sources of water, and water quality, as well as population growth, economic development and planning; sharing technical support and information; exchanging information on funding sources and mechanisms; coordinating efforts to secure water supplies and extend the life of the Hueco Bolson aquifer; examining issues related to rehabilitating existing infrastructure, improving wastewater treatment systems, and examining reuse opportunities; and developing a joint outreach program for the efficient use and re-use of water resources on both sides of the border. *Id.* at 3-4.

109. *See* Tim Steller, *Help From a Hose: Nogales, Ariz., is selling water to dry Nogales, Sonora*, ARIZ. DAILY STAR (July 10, 2002). Under the arrangement, the city of Nogales, Sonora paid Nogales, Arizona the standard rate of $1.80 per 1,000 gallons.

110. *See* INGRAM, *supra* note 101, at 78 (describing the same scenario, during a prolonged regional drought in 1989, in which water was delivered to Mexican tanker trucks across the international boundary for three months via a pipe connected to a metered fire hydrant on the Arizona side).

111. *Id.* at 77-78; VIOLETA MENDOZA, N. AM. CTR. FOR TRANSBORDER STUDIES, ARIZ. ST. UNIV., INFORMAL TRANSBOUNDARY WATER AGREEMENTS: U.S.-MEXICO BORDER 25 (2012).

water from a separate water main crossing the boundary. These connections have operated for decades, though their origins are unknown. The best known among the Mexican businesses is the Hotel Fray Marcos de Niza, which has received water deliveries since at least the 1940s.[112] While the water in the pipe has always flowed from Arizona to Sonora, sometime in the 1990s the public water authority of Nogales, Arizona installed a backflow preventer on the pipe leading to the hotel to prevent the possibility that water originating on the Mexican side might backflow to the American side.[113]

B. HYDRO LOGIC

No two aquifers are alike.[114] Each aquifer is a complex and unique hydrological system.[115] Moreover, no two aquifers are perceived equally by overlaying communities, especially where those communities are highly dependent on aquifer resources to meet their daily freshwater needs.[116] Hence, aquifers traversing the Mexico-U.S. border cannot be managed effectively through a single treaty. While a comprehensive scheme for the administration of these aquifers may be convenient, such an approach would likely be inadequate, could

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112. INGRAM, *supra* note 101, at 75-76; Telephone Interview with Placido dos Santos, formerly with the Arizona Water Institute, Arizona Department of Water Resources, and Arizona Department of Environmental Quality, (August 25, 2011) (*notes on file with author*) [hereinafter dos Santos interview].

113. dos Santos interview, *supra* note 112.

114. *Cf.* Gabriel Eckstein & Yoram Eckstein, *A Hydrogeological Approach to Transboundary Ground Water Resources and International Law*, 19 AM. U. INT'L L. REV. 201, 235-48 (2003) (identifying six disparate models of aquifers with transboundary implications).

115. The complexity of an aquifer is the product of multiple characteristics and functions that encompass the rock formation that forms the matrix of the aquifer as well as the water contained within the saturated portion of that formation. Each aquifer is also distinguishable by the unique qualities that characterize it, such as hydrostatic pressure, hydraulic conductivity, confining characteristics, and the mineralogical, biological, and chemical attributes of the aquifer. Furthermore, each aquifer has discrete functional attributes that are directly related to the unique characteristics that make up the aquifer. Hence, every aquifer operates in unique natural ways that include, *inter alia,* storing and transporting water, diluting wastes and other contaminants, providing habitats for aquatic biota, and serving as sources of fresh water and nutrients to aquifer-dependent ecosystems. Some aquifers even provide geothermal heat, while others have the potential for storing wastes and sequestering carbon. *See generally*, RALPH C. HEATH, U.S. GEOLOGICAL SURVEY, BASIC GROUND-WATER HYDROLOGY, WATER SUPPLY PAPER 2220, 14-15 (1983), *available at* http://pubs.usgs.gov/wsp/2220/report.pdf (last visited Jan. 28, 2013). In addition, the complexity of each aquifer also includes the natural recharge and discharge zones of the aquifer since these zones help to regulate the flow and water quality of water moving into and out of the aquifer and, thereby, the functioning of the aquifer itself. Industrial, agricultural, and municipal development projects undertaken in either of these zones can affect the volume and quality of water percolating into and out of an aquifer. This is true regardless of whether or not these activities are related to the use or management of the aquifer itself. Eckstein, *Commentary*, *supra* note 84, at 585.

116. Transboundary ground water resources are often defined in relation to the idiosyncrasies of local and regional communities, as well as the natural environment, that rely on those resources. Hence, distinctive social, developmental, cultural, or other characteristics, as well as unique environment features like springs and wetlands, can have a profound impact on how an aquifer is perceived and described by overlying communities. *See, e.g.*, Hector M. Arias, *International Groundwaters: The Upper San Pedro River Basin Case* 40 NAT. RESOURCES J. 199 (2000).

only offer very general guidelines and standards, and may prove detrimental to the sustainable management of some of the region's underground water resources. Rather, an effective, sound, and equitable management plan should be tailored to each transboundary aquifer's unique characteristics and circumstances.[117]

The Mimbres Basin Aquifer, for example, which underlies the border-states of New Mexico in the United States and Chihuahua in Mexico, is part of a closed or terminal drainage basin.[118] This uncommon topography means that the catchment has no natural drainage and that water in the basin can only exit through evaporation or human use.[119] Situated at the low-point of the closed basin, recharge of the aquifer highly depends upon precipitation and what little water trickles down the Mimbres River.[120] Discharge from the aquifer consists predominantly of agriculture-related pumping activities.[121]

In contrast, the Rio Grande Aquifer, which follows and underlies much of the upper Rio Grande and traverses the Mexico-U.S. border in the greater El

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117. *See* Hall, *supra* note 3, at 877 (contending that "[w]hile a single mechanism for arriving at a comprehensive solution may not be appropriate, there is reason to be optimistic regarding the achievement of basin-by-basin or case-by-case international agreements on groundwater management that respond better to the diversity of institutional, legal, social, geo-physical, and hydrologic characteristics of each basin"); Evans, *supra* note 3, at 480 (citing to Mumme 2000, *supra* note 19, at 344 for the proposition that "With '[eighteen] different problems areas scattered across eight geographic zones' it is evident why a case-by-case approach might be necessary").

To some extent, an aquifer-by-aquifer approach may be comparable to the basin approach that has long been championed for surface freshwater resources. *See e.g.*, Gabriel Eckstein, *Water Scarcity, Conflict, and Security in a Climate Change World: Challenges and Opportunities for International Law and Policy*, 27 WIS. INT'L L.J. 409, 437-441 (2010) (discussing the need for a basin approach in the context of climate change adaptation). The approach is endorsed by such entities as The World Bank and the European Union. *See*, The World Bank, Water Resources Management, 10-11 (Sept. 1993) *available at* http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2000/02/23/000178830_98101911251888/Rendered/PDF/multi_page.pdf (discussing a need for a comprehensive analysis at the river basin level); Council Directive 2000/EC/60, Oct. 23, 2000, 2000 O.J. (L 327/1) (EC), *available at* http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2000:327:0001:0072:EN:PDF; and DG Environment, European Commission, Water Note 1—Joining Forces for Europe's Shared Waters (Mar. 2008), *available at* http://ec.europa.eu/environment/water/water-framework/pdf/water_note1_joining_forces.pdf. Critical differences, however, exist that relate to the degree (and dearth) of knowledge available on the numerous transboundary aquifers found around the world as well as the extent of dissimilarities evident among the various types and characteristics of these resources. Certainly, it may be possible to formulate generalities and broad, non-specific management objectives for transboundary aquifers. Nevertheless, each transboundary aquifer necessitates a tailored approach that reflects the uniqueness of that particular water body.

118. *See* John W. Hawley, et. al., *Trans-International Boundary Aquifers in Southwest New Mexico*, N.M. WATER RESOURCES RES. INST. 30 (Mar. 2000), *available at* http://wrri.nmsu.edu/publish/otherrpt/swnm/pdf/downl.html.

119. *See* A closed or terminal basin is known in the technical literature as an endorheic watershed. *See* U.N. ENV'T PROGRAMME, DIV. OF TECH., INDUSTRY, & ECON. THE WATERSHED: WATER FROM THE MOUNTAINS INTO THE SEA, *available at* http://www.unep.or.jp/ietc/publications/short_series/lakereservoirs-2/index.asp (*last visited Jan. 26, 2013*).

120. *See* Elaine M. Hebard, *A Focus on a Binational Watershed with a View Toward Fostering a Cross-Border Dialogue*, 40 NAT. RESOURCES J. 281, 303-308 (2000).

121. *See* Hawley, *supra*, note 118 at 36-38.

Paso-Ciudad Juarez area, recharges primarily from the application of surface water to irrigable crops and to a lesser extent by direct seepage from canal and river channels. Additionally, the Rio Grande Aquifer discharges into the adjacent Hueco Bolson Aquifer and the Rio Grande, as well as through numerous wells pumping its groundwater for irrigation.[122]

While agricultural withdrawals are common sources of discharge for both the Mimbres Basin and Rio Grande aquifers, the differences in additional discharge mechanisms, sources of recharge, topographical features, hydrological and geomorphological framework, and other factors are extremely consequential. To attempt to formulate a common management approach for these two highly dissimilar water resources, or most other transboundary aquifers, would be an exercise in futility. Each of these transboundary aquifers necessitates a tailored approach that reflects the uniqueness of each particular water body.

C. LEGAL, EFFECTIVE, OR BOTH?

One concern often raised with a local approach to the management of transboundary natural resources is the legality of such action. As is true under most nations' constitutions, both the Mexican[123] and the U.S.[124] instruments recognize the national government as the sole authority empowered to deal with foreign representatives; they prohibit states, cities, and other subnational political units from entering into treaties and other formal relations with counterparts across the border.[125]

However, numerous American state and local governments have engaged in a variety of international relations ranging from cultural exchanges[126] to international trade and investment[127] to takings stands on international affairs.[128] Moreover, some evidence suggests that the federal U.S. government tolerates independent state and local government involvement in foreign affairs and even defers to the states with respect to certain responsibilities imposed under various

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122. TRANSBOUNDARY AQUIFERS, *supra* note 82.

123. *See* Constitución Política de los Estados Unidos Mexicanos [C.P.], *as amended*, art. 117, Diario Oficial de la Federación [DO], 5 de Febrero de 1917 (Mex.), *translation available at* http://www.juridicas.unam.mx/infjur/leg/constmex/pdf/consting.pdf (last visited Jan. 28, 2013) (providing in subsection I. that "No State shall Enter into any Treaty, Alliance or Confederation either with other State or with foreign nations").

124. *See* U.S. CONST. art. I, § 10, cl. 3 (providing that "No State shall, without the Consent of Congress . . . enter into any Agreement or Compact with another State, or with a foreign Power").

125. *See* Richard B. Bilder, *The Role of States and Cities in Foreign Relations*, 83 AM. J. INT'L L. 821, 823-24 (1989).

126. Michael H. Shuman, *Dateline Main Street: Local Foreign Policies,* 65 FOREIGN POL'Y 154, 157-58 (1986-87); Evans, *supra* note 3, at 493.

127. *See* Curtis A. Bradley, *Symposium Overview: A New American Foreign Affairs Law?,* 70 U. COLO. L. REV. 1089, 1097 (1999); *Evans,* supra note 3, at 493.

128. *See* Shuman, *supra* note 126, at 160-61 (discussing the political stance and policies that many American cities took in response to South Africa's Apartheid).

international treaties.[129]

More to the point, concern over the legality or illegality of a local approach to transboundary aquifer relations may be unwarranted. This article does not counsel the creation of multiple, locally-specific, formal treaties all along the border (albeit, this could be an attractive route to follow at some point in the future). Rather, it proposes the development and implementation of locally-specific *arrangements* that could be as informal as a "Memorandum of Understanding,"[130] or a more structured contract for goods or services. While the former could be immune to Constitutional scrutiny due to its unofficial, unenforceable, and non-binding nature, the latter would be immune to the extent that Congress has not preempted such activities under its authority to regulate interstate commerce.

1. Unofficial Arrangements

The use of Memoranda of Understanding and other unofficial, informal arrangements have a long history in international relations, at least at the nation-to-nation level, and governments worldwide use them for a variety of purposes.[131] They are justified mostly because of their simplicity, lower public profile, speed, and flexibility when compared to the formality and procedures required of treaties.[132] In addition, there is growing evidence that in certain national and transboundary contexts, an informal approach to managing environmental issues may be more effective than binding accords for achieving cooperation.[133] The aforementioned MoU entered into between the public water utilities of Juárez and El Paso is but one example on the Mexico-U.S. border.[134]

Similar arrangements for local management of transboundary waters can be

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129. *See Evans*, supra note 3, at 497-99.

130. Other variations include "Memorandum of Agreement," "Letter Agreement," or even oral or so-called handshake agreements.

131. *See* Anthony Aust, *The Theory and Practice of Informal International Instruments*, 35 INT'L & COMP. L.Q. 787, 788 (1986) (noting that "informal instruments are employed in almost every field of international relations-diplomatic, defence, commercial, aid, transport. There is probably no area where they are not found."); Charles Lipson, *Why are Some International Agreements Informal*, 45 INT'L ORG. 495, 495-96 (1991) (discussing the use and value of informal agreements for international monetary affairs and security relationships).

132. *See* Lipson, *supra* note 131, at 500-01, 514-23. Because informal arrangements place fewer demands on the parties than their formal counterparts, they are far simpler and require less time to craft and achieve. As a result, they also tend to be more accommodating of changing circumstances and are typically more easily amendable. Finally, because of their informality and less-than-binding nature, they tend to be less controversial and, hence, generate less scrutiny. *See id.*

133. *See e.g.*, Ingo Heinz, *Voluntary agreements as an instrument to solve conflicts between farmers and water suppliers, in* AGRICULTURAL EFFECTS ON GROUND AND SURFACE WATERS: RESEARCH AT THE EDGE OF SCIENCE AND SOCIETY 11 (2002), *available at* http://itia.ntua.gr/hsj/redbooks/273/hysj_273_000.pdf#page=21 (describing a positive European experience with cooperative agreements between farmers and water suppliers for reducing water pollution); *see generally* DAVID G. VICTOR, ET AL., THE IMPLEMENTATION AND EFFECTIVENESS OF INTERNATIONAL ENVIRONMENTAL COMMITMENTS: THEORY AND PRACTICE (1998).

134. *See supra* notes 106-108, and accompanying text.

found on the Canada-U.S. border.[135] For example, in 1996, the Department of Ecology of the U.S. State of Washington and the Ministry of Environment, Lands and Parks of the Canadian Province of British Columbia entered into a Memorandum of Agreement (MoA) over the transboundary Abbotsford-Sumas Aquifer.[136] Likewise, most small European transboundary aquifers are now managed successfully by local authorities under subnational transboundary arrangements.[137]

2. Contracts for Goods and Services

Contracts for goods and services are legally-binding agreements in which one party agrees to provide to the other some product or service in exchange for something of value (such as a fee).[138] In a cross-border context, this means that the parties come from opposite sides of a border and supply or receive the good or service across that border.[139] Accordingly, in the example noted previously,

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135. *See* Forest, *supra* note 101, at 755 (presenting research that "shows that close to a quarter of all twin borderland communities are involved in water transfers, out of the 59 twin communities contacted").

136. *See* Memorandum of Agreement Related to Referral of Water Right Applications between the State of Wash., Dep't of Ecology and the Province of B.C., Minister of Env't, Lands & Parks, Oct. 10, 1996, [hereinafter 1996 BC/WA MoA], *available at* http://internationalwaterlaw.org/documents/regionaldocs/Local-GW-Agreements/1996-BC-WA-Water-Right-Referral-Agreement.pdf. Among other things, the MoA defines the roles and responsibilities of the two parties and of their permitting agencies to allow timely prior consultation, comment period, and exchange of information on water quantity allocations within each party's territory that "could potentially significantly impact water quantity on the other side of the border." *Id.* Under the MoA's umbrella, local stakeholders and industry groups have become very active in the coordination and management of the aquifer. *See* Norman & Melious, *supra* note 102, at 202-203.

It is noteworthy that prior to the MoA, Washington's Department of Ecology and British Columbia's Ministry of Environment, Lands and Parks had established an International Task Force for the Abbotsford Sumas Aquifer whose aims were to: develop a joint ground water management plan; coordinate efforts aimed at protecting the aquifer; develop aquifer management strategies using a managerial approach; and facilitate and coordinate education and public involvement in water management issues. *See* Summary of Meeting of the B.C.-Wash. Envtl. Cooperation Council, Oct. 1, 1992, *available at* http://www.env.gov.bc.ca/spd/ecc/docs/borderline_news/meeting92.pdf (last visited Jan. 28, 2013).

137. Jochen Sohnle, Transboundary Aquifers and Local Transfrontier Co-operation in Europe (Feb. 2006) (unpublished report prepared for the UNILC Special Rapporteur, His Excellency, Ambassador Chusei Yamada and the UNESCO Ground Water Experts Group) (on file with author). In the European context, local management of these transboundary ground water resources is a function of both subsidiarity (*see* Huffman, Vischer, and Carozza *supra* note 95), as well as the fact that the *European Outline Convention on the Transfrontier Cooperation between Territorial Communities or Authorities* authorizes subnational units to enter into transboundary arrangements under certain circumstances. *See* European Outline Convention on the Transfrontier Cooperation between Territorial Communities or Authorities, May 21, 1980), *available at* http://conventions.coe.int/treaty/en/treaties/html/106.htm. The purpose of this treaty is to encourage and facilitate trans-border cooperation between neighboring communities across an international boundary on issues relevant to both sides, especially in the fields of "regional, urban and rural development, environmental protection, the improvement of public facilities and services and mutual assistance in emergencies." *See id.* at Preamble.

138. *See* E. ALLAN FARNSWORTH, CONTRACTS 3-9 (4th ed. 2004) (summarizing sections 1.1, 1.2, and 1.3).

139. The treatment of water as a good or commodity is a highly controversial issue internationally, especially in the context of bulk water transfers and sales. *See e.g. generally*, Gregory F. Szydlowski, *The Commoditization of Water: A Look at Canadian Bulk Water Exports, the Texas Water Dispute and the Ongoing Battle Under*

certain businesses and private residences in Nogales, Sonora obtain their potable water from the Nogales, Arizona public water authority through pipes crossing the international border and each customer pays the provider individually.[140] Utilizing a different arrangement, residents of Derby Line, Vermont and Stanstead, Quebec obtain their potable water from a private company owned collectively by the two municipalities. While a transboundary aquifer serves as the source of the water, the wells are located in Stanstead, Quebec.[141] Interestingly, Derby Line and Stanstead also have an arrangement by which wastewater from both communities is treated on the Canadian side.[142]

D. PROCESS OVER SUBSTANCE

Given that each arrangement is envisioned to be locally-specific—tailored to the unique geographic, hydrogeologic, climatic, and environmental idiosyncrasies of the local aquifer, responsive to local community concerns, and reflective of the values of stakeholders on both sides of the border—any attempt to formulate universal recommendations for a local approach would be difficult, if not futile. Nevertheless, much can be said for suggestions that embrace the multitude of possible dissimilarities and that offer guidelines for pursuing cooperation rather than dictating criteria for success. One lesson to emphasize in pursuit of a local approach is that the formulation of procedures can take precedence over a determination of substantive rights.[143]

Determining states' substantive water rights represents one of the most

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NAFTA for Control of Water Resources, 18 COLO. J. INT'L ENVTL. L. & POL'Y 665 (2007) (considering whether water is a good or commodity under international trade law and the North Atlantic Free Trade Agreement); Bryant Walker Smith, *Water as a Public Good: The Status of Water Under the general Agreement on Tariffs and Trade*, 17 CARDOZO J. INT'L & COMP. L. 291 (2009) (arguing that water is not a "product" subject to the World Trade Organization's General Agreement on Tariffs and Trade). Under U.S. law, however, water is regarded as an article of commerce and, with some limitations, states are prohibited from restricting the interstate sale of water. *See generally* Sporhase v. Nebraska ex rel. Douglas, 458 U.S. 941 (1982); City of El Paso v. Reynolds, 563 F. Supp. 379 (D.N.M. 1983); City of El Paso v. Reynolds, 597 F. Supp. 694 (D.N.M. 1984).

140. *See supra* notes 111-113 and accompanying text.

141. *See* PATRICK FOREST, A CENTURY OF SHARING WATER SUPPLIES BETWEEN CANADIAN AND AMERICAN BORDERLAND COMMUNITIES, MUNK SCHOOL BRIEFINGS NO. 15, 19-20 (Oct. 2010), *available at* http://munkschool.utoronto.ca/wp-content/uploads/2012/07/Forest_SharingWaterSupplies_POWI_2010.pdf.

142. *Id.*

143. *Cf.* OSCAR SCHACHTER, SHARING THE WORLD'S RESOURCES 69 (1977). Schachter asserts that:

> It is reasonable . . . that procedural requirements should be regarded as essential to the equitable sharing of water resources. They have particular importance because of the breadth and flexibility of the formulae for equitable use and appropriation. In the absence of hard and precise rules of allocation, there is a relatively greater need for specifying requirements for advance notice, consultation, and decision procedures.

Id. See also STEPHEN C. MCCAFFREY, THE LAW OF INTERNATIONAL WATERCOURSES 480 (2d ed. 2007) (contending that "The key to the maintenance over time of a regime of equitable utilization is regular communication . . . this simple practice, which usually occurs on the technical level, not only enables states to discharge their obligations of equitable utilization, but also can be of assistance in the avoidance of disputes").

complex aspects of achieving successful transboundary water cooperation. While international water law does offer generic principles designed to guide nations on how to allocate and manage transboundary waters,[144] ascertaining what these entitlements might actually entail, especially in terms of water allocations, is fraught with difficulties and can become an obstacle to cooperation and the development of a transboundary water accord.[145] Difficulty arises because states' rights are founded on notions of sovereignty, and any scenario that asks a government to relinquish its rights, or even its claims of rights, to territory can diminish that government's stature in the eyes of its populace and neighbors.[146] Managing ground water can be especially controversial since states find difficulty differentiating between the soil of their territory and the groundwater flowing through that soil.[147]

Cooperation over procedural conditions related to transboundary waters, on the other hand, might be perceived as a lesser menace or a relatively minor threat to sovereignty. Procedural cooperation tends only to impose obligations related to information about shared waters rather than about ownership in and rights to those waters. As a result, states with little information about their transboundary aquifers, as well as those with a history of animosity or conditions disfavoring water allocations, may be more apt to enter into water-related arrangements that only require procedural obligations than to agree to arrangements that also address substantive water rights.[148]

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144. For example, international water law provides that states are entitled to the equitable and reasonable utilization of transboundary waters as well as the right not to suffer significant harm from the use of those waters by other riparian and aquifer states. *See* Gabriel Eckstein, *Managing Buried Treasures Across Frontiers: The International law of Transboundary Aquifers*, 36 WATER INT'L 573, 579-80 (2011) [hereinafter Eckstein, *Managing Buried Treasures*].

145. An example in which negotiations over water rights hindered the development of cooperative water arrangements is the negotiations between Israelis and Palestinians over the Jordan River and Mountain Aquifer. *See* Itay Fischhendler, Aaron T. Wolf, and Gabriel Eckstein, *The Role of Creative Language in Addressing Political Realities: Middle-Eastern Water Agreements*, *in* SHARED BORDERS, SHARED WATERS: ISRAELI-PALESTINIAN AND COLORADO RIVER BASIN WATER CHALLENGES 63-65, 68-70 (2013).

146. In the mind of many politicians and governments, a nation's sovereignty, as the cornerstone of modern state relations and international law, is sacrosanct and can never be undermined. Hence, a loss of sovereignty, whether actual or perceived, is often a highly political and potentially destabilizing issue domestically as well as internationally. This can be especially troublesome in regions of conflicts, such as the Middle East and South Asia, but can also occur among cooperative nations where the subject matter—here, ground water resources—may not be well understood. Gabriel Eckstein, *A Hydrogeological Perspective of the Status of Ground Water resources Under the UN Watercourse Convention*, 30(3) COLUM. J. ENVTL. L. 525, 528 (2005) (noting that "In the past, legal professionals have described ground water as "secretive," "mysterious," and even "occult," thus evidencing the gap in scientific understanding among jurists and practitioners").

It is noteworthy that this absolutist notion of state sovereignty, at least in the context of transboundary waters, has been discounted and discarded. *See* MCCAFFREY, *supra* note 143, at 112-126.

147. *See* MCCAFFREY, *supra* note 143, at 485. While sovereignty clearly applies to the soil and land of a nation, international water law limits sovereign rights to water flowing over the land or through a nation's soil. *Id. See also* Eckstein, *Managing Buried Treasures*, *supra* note 144, at 577-79 (describing the evolving customary international law limiting sovereignty rights to transboundary aquifers and their waters).

148. Two aquifer agreements that may have developed along this line of reasoning include the Programme

Pursuing procedural cooperation in no way negates development of broader aquifer-specific agreements that incorporate substantive rules of allocation and water rights. Rather, it can serve as a first step in a gradual and sequential approach to cooperation over transboundary water resources, especially where relations are less than ideal, unique circumstances make allocation unlikely, or knowledge of the particular water resource remains limited. As cooperation develops and as trust between aquifer states grows, procedural cooperation efforts could form a foundation upon which to enhance relations for eventual negotiations over substantive water rights.

Among others, examples of procedural cooperation that could be incorporated into many transboundary aquifer arrangements might include some or all of the following.

1. Regular Exchanges of Data and Information

The regular exchange of data and information related to the character, use, and functioning of a transboundary aquifer can be a relatively benign basis upon which to build cooperation over the resource. Even in regions with minimal trust, exchanging available material can help bridge misgivings and renew cooperation.[149] Such exchanges could encompass the transfer of existing information as well as any newly developed data[150] and could be structured in the context of

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for the Development of a Regional Strategy for the Utilisation of the Nubian Sandstone Aquifer System (NSAS) —Terms of Reference For the Monitoring and Exchange of Groundwater Information of the Nubian Sandstone Aquifer System (Oct. 5, 2000); and Establishment of a Consultation Mechanism for the Northwestern Sahara Aquifer System (SASS) (2002), *both available at* http://www.fao.org/docrep/008/y5739e/y5739e05.htm.

149. Of course, where information is regarded as a security issue, such an exchange may become frustrated as a result of one or more parties declining to exchange available data. Notwithstanding, Article 19 of the Draft Articles on Transboundary Aquifers, which were formulated by the UN International Law Commission, provides:

> *Data and information vital to national defence or security*
>
> *Nothing in the present articles obliges a State to provide data or information vital to its national defence or security. Nevertheless, that State shall cooperate in good faith with other States with a view to providing as much information as possible under the circumstances.*

Res. 63/124, *supra* note 81, at art. 19.

150. It is noteworthy that Article 8 of the Draft Articles on Transboundary Aquifers, entitled *Regular exchange of data and information*, provides:

> *1. Pursuant to article 7, aquifer States shall, on a regular basis, exchange readily available data and information on the condition of their transboundary aquifers or aquifer systems, in particular of a geological, hydrogeological, hydrological, meteorological and ecological nature and related to the hydrochemistry of the aquifers or aquifer systems, as well as related forecasts.*
>
> *2. Where knowledge about the nature and extent of a transboundary aquifer or aquifer system is inadequate, aquifer States concerned shall employ their best efforts to collect and generate more complete data and information relating to such aquifer or aquifer system, taking into account current practices and standards. They shall take such action individually or jointly and, where appropriate, together with or through international organizations.*

regularly scheduled meetings, periodic conferences, and cooperation among academics and research institutions, or on an ad hoc basis.[151]

2. Monitoring

The need to conduct continuous monitoring efforts on a transboundary aquifer is a corollary to the regular exchange of data and information. Monitoring effectively serves to extend and maintain those regular exchanges and provides systematic checks on the particular transboundary aquifer's character, use, and functioning.[152] Although focusing on projects implemented on transboundary watercourses, the International Court of Justice in its recent decision in the *Case Concerning the Pulp Mills on the River Uruguay* asserted that "once operations have started and, where necessary, throughout the life of the project, continuous monitoring of its effects on the environment shall be undertaken."[153]

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3. If an aquifer State is requested by another aquifer State to provide data and information relating to an aquifer or aquifer system that are not readily available, it shall employ its best efforts to comply with the request. The requested State may condition its compliance upon payment by the requesting State of the reasonable costs of collecting and, where appropriate, processing such data or information.

4. Aquifer States shall, where appropriate, employ their best efforts to collect and process data and information in a manner that facilitates their utilization by the other aquifer States to which such data and information are communicated.

Res. 63/124, *supra* note 81, at art. 8.

151. *See* Eckstein, *Managing Buried Treasures*, *supra* note 144, at 577-78; Eckstein, *Commentary*, *supra* note 84, at 578-79.

152. *See* Eckstein, *Managing Buried Treasures*, *supra* note 144, at 578. Article 13 on *Monitoring* of the Draft Articles on Transboundary Aquifers provides:

1. Aquifer States shall monitor their transboundary aquifers or aquifer systems. They shall, wherever possible, carry out these monitoring activities jointly with other aquifer States concerned and, where appropriate, in collaboration with competent international organizations. Where monitoring activities cannot be carried out jointly, the aquifer States shall exchange the monitored data among themselves.

2. Aquifer States shall use agreed or harmonized standards and methodology for monitoring their transboundary aquifers or aquifer systems. They should identify key parameters that they will monitor based on an agreed conceptual model of the aquifers or aquifer systems. These parameters should include parameters on the condition of the aquifer or aquifer system as listed in article 8, paragraph 1, and also on the utilization of the aquifers or aquifer system.

Res. 63/124, *supra* note 81, at art. 13.

153. Pulp Mills on the River Uruguay (Arg. v. Uru.), Judgment, 2010 I.C.J. 18, para. 205 (Apr. 20). Former Vice-President of the International Court of Justice, Judge Christopher Weeramantry, proposed that the duty to monitor is better styled as a principle of continuing environmental impact assessment that can only be accomplished through the regular exchange of data and information. *See* Gabčikovo-Nagymaros Project (Hung. v. Slovk.), 1997 I.C.J. 88 (Sept. 25) (separate opinion of Vice-President Weeramantry). In that opinion, Judge Weeramantry opined that "[a]s long as a project of some magnitude is in operation, [an environmental impact assessment] must continue, for every such project can have unexpected consequences; and considerations of prudence would point to the need for continuous monitoring." *Id.* at 111.

3. Prior Notification of Planned Measures

Pursuit of a project with transboundary implications without alerting one's cross-border neighbor of the plans or possible consequences can destroy trust between border communities.[154] Hence, a process requiring prior notification to potentially affected aquifer states of planned measures that may have adverse transboundary impacts could have a profoundly positive impact on cross-border relations. Moreover, notice could encourage cooperation, especially when accompanied by available information on the project's potential transboundary impacts, such that the receiving state could begin evaluating the situation, and the acting state could make a commitment not to pursue the project during that evaluation period.[155]

4. Cross-border Public Participation

As noted previously,[156] participation by local stakeholders, and the public in general, improves the quality of decisions, facilitates the decision-making process, improves credibility, and enhances implementation.[157] The fact that an international boundary segregates the various stakeholders should not be a bar to

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154. While the infamous Trail Smelter case focused primarily on the transboundary harm caused by Tech Cominco (a Canadian company operating in the city of Trail in British Columbia) to farms, orchards, and residents of Washington State, it was understood that neither the company nor its host province or nation provided Washington State or the United States with prior notice of their operations, which clearly had detrimental transboundary consequences. The result was the arbitration in which Canada was found liable to the United States for the actions of Tech Cominco. *See generally* Trail Smelter Arbitration (U.S. v. Canada), 3 R.I.A.A. 1911 (1941).

155. *See* Eckstein, *Managing Buried Treasures*, *supra* note 144, at 578-79. Article 15 of the Draft Articles on Transboundary Aquifers, entitled *Planned activities*, provides:

> *1. When a State has reasonable grounds for believing that a particular planned activity in its territory may affect a transboundary aquifer or aquifer system and thereby may have a significant adverse effect upon another State, it shall, as far as practicable, assess the possible effects of such activity.*
>
> *2. Before a State implements or permits the implementation of planned activities which may affect a transboundary aquifer or aquifer system and thereby may have a significant adverse effect upon another State, it shall provide that State with timely notification thereof. Such notification shall be accompanied by available technical data and information, including any environmental impact assessment, in order to enable the notified State to evaluate the possible effects of the planned activities.*
>
> *3. If the notifying and the notified States disagree on the possible effect of the planned activities, they shall enter into consultations and, if necessary, negotiations with a view to arriving at an equitable resolution of the situation. They may utilize an independent fact-finding body to make an impartial assessment of the effect of the planned activities.*

Res. 63/124, *supra* note 81, at art. 15.

156. *See supra* notes 93-113 and accompanying text.

157. CARL BRUCH ET AL., *From Theory to Practice: An Overview of Approaches to Involving the Public in International Watershed Management*, *in* PUBLIC PARTICIPATION IN THE GOVERNANCE OF INTERNATIONAL FRESHWATER RESOURCES 3, 6 (2005).

their participation in the administration of an aquifer with cross-border implications. Hence, border communities overlaying a transboundary aquifer, as well as stakeholders from both sides of the boundary, should be afforded the opportunity to present their concerns and become involved in the decision-making process.[158] Such participation is especially critical at the planning and information evaluation phases, as well as at all significant decision-making stages.

V. CONCLUSION

Ground water resources all along the Mexico-U.S. border are experiencing significant stress from overexploitation, contamination, and mismanagement. Worse, that scenario plays out on both sides of the border with little regard for consequences. Imminently unsustainable, the situation portends the possible downfall of the numerous border communities that rely on these transboundary aquifers for their sustenance. While the circumstances continue to grow dire, calls for a formal, border-wide solution have elicited little if any interest at the respective national levels.

As a result of the inaction by both nations' governments, communities on the Mexico-U.S. border have little choice but to take matters into their own capable hands. In order for them to achieve viable and sustainable cross-border pacts that will ensure the water futures of their people, economies, and environment, local authorities must overcome the presumption that transboundary arrangements exist within the exclusive domain of the federal authorities, learn to rely on their own initiative and resourcefulness and pursue a course of action that will ensure the sustainability of their local fresh water resources into the future, reach out across the frontier to their cross-border neighbors and friends, and seek out locally-relevant, collaborative solutions.

158. *See* Eckstein & Hardberger, *supra* note 91, at 119-20. An example in which a measure of cross-border participation was incorporated into a subnational transboundary arrangement is the 1996 MoA between British Columbia and Washington State over the Abbotsford Aquifer. That arrangement calls on the relevant permitting agencies on either side of the border to provide a comment period to their counterparts before approving a water quantity allocation. *See* 1996 BC/WA MoA, *supra* note 136, at 5; *see also* Eckstein & Hardberger, *supra* note 91, at 117.