



Update on the Transboundary Aquifer Assessment Program, with a focus on the Arizona-Sonora Components

Sharon B. Megdal, Ph.D.

US IBWC Southeast Arizona Citizens Forum

March 19, 2024



THE UNIVERSITY OF ARIZONA
COOPERATIVE EXTENSION

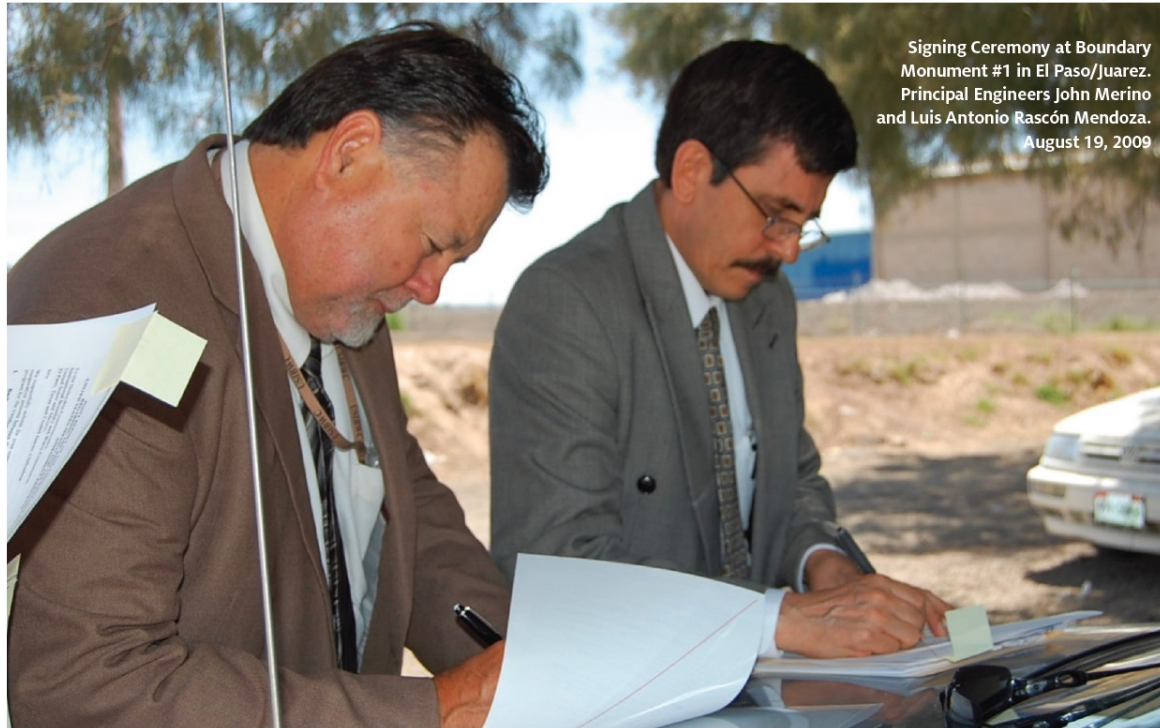
**WATER RESOURCES
RESEARCH CENTER**

smegdal@arizona.edu



wrrc.arizona.edu

2009-2019



Signing Ceremony at Boundary Monument #1 in El Paso/Juarez. Principal Engineers John Merino and Luis Antonio Rascón Mendoza. August 19, 2009

Reflections on the 10th Anniversary of the Transboundary Aquifer Assessment Program and the Importance of its Joint Cooperative Process

by Sharon B. Megdal
08/23/2019

On August 19, 2009, the Principal Engineers representing the binational International Boundary and Water Commission (IBWC) signed the “Joint Report of the Principal Engineers Regarding the Joint Cooperative Process United States-Mexico for the Transboundary Aquifer Assessment Program” (Joint Report). [The Joint Report enabled scientists and government officials](#) from the United States and Mexico to partner in assessing their shared aquifers, an effort that aligns with principles that advance [sustainable groundwater management and governance](#).



Earthquake damage, Mexicali Valley, 2010. Source (clockwise from top left): 1-2, Jeffrey Silvertooth; 3, Mexican Section, IBWC; 4-5, CONAGUA

Reflections: On April 4, Easter, and the Earthquake

by Sharon B. Megdal
04/09/2021

In 2021, the Easter holiday once again fell on April 4, which happens to be my birthday. This coincidence previously happened in 1999 and 2010. For different reasons, I think back to both. In 1999, Tucson, Arizona experienced snow on Easter morning. The highly unusual April snowfall was beautiful and brief, with all signs of snow quickly disappearing as the sun came out and temperatures warmed. A very different natural phenomenon occurred during the afternoon hours of Easter 2010; a devastating earthquake lasting about 1.5 minutes hit northwestern Mexico and southern California. Measuring 7.2 on the moment magnitude scale, the 2010 Easter earthquake inflicted terrible damage, including destruction of water delivery infrastructure in Mexico.

2010-2021



Joint Report of the Principal Engineers Regarding the Joint Cooperative Process United States-Mexico for the Transboundary Aquifer Assessment Program

INTERNATIONAL BOUNDARY AND WATER COMMISSION
UNITED STATES AND MEXICO

El Paso, Texas
August 19, 2009

**JOINT REPORT OF THE PRINCIPAL ENGINEERS
REGARDING THE JOINT COOPERATIVE PROCESS
UNITED STATES-MEXICO FOR THE TRANSBOUNDARY AQUIFER
ASSESSMENT PROGRAM**

To the Honorable Commissioners,
International Boundary and Water Commission,
United States and Mexico,
El Paso, Texas and Ciudad Juarez, Chihuahua.

Sirs:

We respectfully submit for your consideration this Joint Report recommending the joint cooperative process between the United States and Mexico to implement an assessment program for the transboundary aquifers shared by both countries.

I. Background

Since the decade of the 1970s, there exists within the framework of the International Boundary and Water Commission (IBWC), a process for the exchange of information on groundwater along the border between the United States and Mexico. Any issues of data or studies have been addressed on a case by case basis through mutual consultation as established in Resolution 6 of IBWC Minute No. 242.

By way of example, on December 2, 1997, the IBWC issued the "Joint Report of Principal Engineers Regarding Information Exchange and Mathematical Modeling in the El Paso, Texas and Ciudad Juarez, Chihuahua Area Aquifer." The IBWC arranged for the exchange of groundwater data between both countries and the development of a bilingual publication that was produced jointly under this effort.

On December 22, 2006, United States Public Law 109-448, the "United States-Mexico Transboundary Aquifer Assessment Act" was passed, establishing a program to evaluate transboundary aquifers between the United States and Mexico, which included the possibility of applying United States funds for assessment activities in Mexico.

II. International Boundary and Water Commission's Position and Process Framework

The IBWC, United States and Mexican Sections, are aware of the interest on both sides of the border to preserve and understand the aquifers used by both countries, whereby it is considered necessary to develop a team of binational experts to assess transboundary aquifers, exchange data, and if needed, develop new datasets.

Initiatives that include transboundary water resources are traditionally coordinated through the IBWC using the customary binational cooperation process used by both

INTERNATIONAL BOUNDARY AND WATER COMMISSION
UNITED STATES AND MEXICO

Sections of the Commission. The IBWC, under this joint cooperative process, will provide the framework for coordination of binational aquifer assessment activities conducted by U.S. and Mexican agencies, universities, and others participating in the program.

III. Objectives

The objective of the joint cooperative process for groundwater research is to improve the knowledge base of transboundary aquifers between the United States and Mexico.

To further this process, the following will be carried out within the IBWC framework:

1. Facilitate the exchange of data and assure the concurrence of the United States and Mexico for binational aquifer assessment activities.
2. Facilitate agreement on the aquifers that will be evaluated jointly.
3. Establish and coordinate binational technical advisory committees for each identified transboundary aquifer.
4. Establish an official repository for binational project reports developed under the program.

IV. Framework/Process (Roles and Responsibilities)

1. Either of the two countries can propose an aquifer to study. Within the IBWC framework it will be determined whether the proposal is in the common interest and, as appropriate, a joint program developed.
2. For projects selected, the IBWC will coordinate with agencies from both countries to jointly define the scope of the assessment leading to a binational scope.
3. Binational Technical Groups will be established, coordinated by the IBWC, to address and define the scope of each joint assessment.
4. The IBWC will facilitate concurrence of joint work plans.
5. Whoever carries out the joint studies will update the Binational Technical Groups with the progress of the projects as frequently as is agreed upon in each case, and these Groups will make appropriate observations and recommendations until the studies are accepted.
6. The final reports which proceed from the joint studies will be published in English and Spanish and will be made available for publication once they have been approved within the IBWC framework.

V. Funding

Each country will be responsible for any costs on projects conducted in its territory, in addition to selecting the participants and consultants to carry out the studies in that country. Either country may contribute to costs for work done in the other country. This contribution will be distributed according to the process agreed upon through the IBWC.

All projects and measures considered under this joint cooperative process are subject to the availability of funds and it is understood that agreeing to pursue with the evaluation

INTERNATIONAL BOUNDARY AND WATER COMMISSION
UNITED STATES AND MEXICO

of a specific project or activity does not commit any of the participants to provide funding for the execution of projects and measures.

VI. Principles of the Agreement

1. The activities described under this agreement should be beneficial to both countries.
2. The aquifers to be jointly studied, as well as the scope of the studies or activities to be done on each aquifer, should be agreed upon within the framework of the IBWC.
3. The activities should respect the legal framework and jurisdictional requirements of each country.
4. No provision set forth in this agreement will limit what either country can do independently in its own territory.
5. No part of this agreement may contravene what has been stipulated in the Boundary and Water Treaties between the two countries.
6. The information generated from these projects is solely for the purpose of expanding knowledge of the aquifers and should not be used by one country to require that the other country modify its water management and use.

VII. Communication and Use of Information

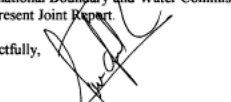
1. The IBWC will be an official repository of records generated by the binational projects, meetings, studies, and any information exchanged and/or presented. The final joint binational reports will be available to the public in each country and will be posted on the website of each Section of the Commission once they have been approved within the framework of the IBWC.
2. Information obtained and used as part of binational activities should be considered as official data and should be shared without any restrictions with stakeholders in both countries who participate in the joint projects.
3. Credit will be given to those who provide information.

RECOMMENDATION

That the activities for the joint cooperative process related to the transboundary aquifer assessment program be adopted by the International Boundary and Water Commission in accordance with the terms described in the present Joint Report.


John Merino
Principal Engineer
United States Section

Respectfully,


Luis Antonio Rascón Mendoza
Principal Engineer
Mexican Section



Public Policy Review

by Sharon Megdal

Front-Row View of Federal Water Lawmaking Shows Process Works

U.S. – Mexico Transboundary Aquifer Assessment Act pondered, passed and signed



Otto von Bismarck reportedly once said, “Laws are like sausages, it is better not to see them being made.” I am not sure what to make of this remark since lawmaking, not sausage making, is my interest. It is an interest that recently broadened when I had the privilege of testifying before the Water and Power Subcommittee of the House Resources Committee on the United States-Mexico

Transboundary Aquifer Assessment Act. This bill, numbered S 214 in the Senate and HR 469 in the House, gained final approval in the wee hours of the 109th Congress and was signed by the President on December 22. My previous involvement in lawmaking had been at the state level.

The program’s purpose is to provide state, national and local officials with information to address pressing water resource challenges in the U.S.-Mexico border region. As finalized, the act authorizes the Secretary of the Interior, through the U.S. Geological Survey, to collaborate with the states of Arizona, New Mexico and Texas, the country of Mexico, and others to conduct hydrologic characterization, mapping and assessments of priority transboundary aquifers. For Arizona, the two priority transboundary aquifers established in the legislation are the Santa Cruz River Valley and San Pedro aquifers. The program is authorized for ten years.

Working on obtaining Congressional approval of this bill was a learning experience. I had once provided written testimony to a Congressional subcommittee, but I had not previously had the opportunity to provide oral testimony.

The acting USGS director and I were the only witnesses. Some unexpected, tough questions came up at the hearing regarding the bill’s connection to the Colorado River and the treaty with Mexico. The Subcommittee chairman held the bill to allow additional comments. Through the assistance of staff to Senators Kyl and Bingaman, respectively, amendments to address multiple concerns with the bill’s language were developed.

In contrast to sausage making, which must be a very messy business, I was participating in a carefully crafted lawmaking process involving compromise and clarification to achieve agreement and support.

As a witness on the bill, I first provided written testimony and then was given a few minutes to provide oral remarks at the hearing. The oral remarks were not expected to be the same as the written testimony. I emphasized the importance of the bill by making the following points.

I testified that the transboundary aquifer assessment program will assist federal, state and local officials address critical water resource challenges in the U.S.-Mexico border region. The act will build the scientific foundation for addressing daunting and acute

water resource issues. The program also will serve as a catalyst bringing together the human capital and financial resources necessary to characterize transboundary aquifers. The resulting increased understanding should help resolve many of the currently unquantified — and therefore unresolved — water resource issues.

I emphasized the importance of water to the growing, arid Southwest, especially along the border where population continues to grow rapidly on both sides. Water resource issues become more complex and acute along the shared border where understanding aquifer characteristics is critical to the human health and economic vitality of this region. Along the border many and varied interests need to cooperate and participate to address water issues.

I told how the modeling and data base developed as part of the program will address important water quantity questions including those associated with salinity and toxins. Further complicating border water issues are the different water quality standards and the physical relationship between surface water and subsurface flows associated with transboundary aquifers that raise special challenges.

I also told the subcommittee that the program authorized by this bill will meet a critical need by establishing a partnership of federal, state and local governments, university researchers and others to provide scientific information on transboundary aquifers.

I informed the committee that the need for additional scientific information on water resources is well recognized. For example, in fall 2004, the 85th Arizona Town Hall concluded that “[to] avoid crisis management, Arizona must engage in long-term planning based on good science and data collection that should be made widely available throughout the state.” Town Hall participants were calling for sound science and data as well as the dissemination of the information to avoid crisis. The program authorized by the bill envisions the partnerships necessary to accomplish these tasks.

I noted the widespread support for the bill from governmental and non-governmental entities. In addition, a 2005 United States-Mexico Border Governors’ Conference declaration emphasized the importance of the program by calling for a collaborative work program that includes “the permanent exchange of data and information regarding surface and ground water along the border...”

Passage of the act demonstrated once again that water policy making is a bi-partisan exercise. All recognize the need for sound information to develop good water policies to ensure needed water supplies to accommodate the rapid growth of the border regions. Funding for this newly authorized program is needed, and the hard work of obtaining federal appropriations now begins.

The University of Arizona’s Water Resources Research Center and its sister centers in New Mexico and Texas are expected to work closely with USGS and collaborators on developing this program. I thank those who helped us get this far and look forward to working on implementing this legislation. 🌵



Public Policy Review

The Cooperative Framework for the Transboundary Aquifer Assessment Program: A Model for Collaborative Transborder Studies

Sharon B. Megdal

Being part of the team working on the Transboundary Aquifer Assessment Program (TAAP) continues to be gratifying. The International Boundary and Water Commission’s (IBWC) recent publication of the *Binational Study of the Transboundary San Pedro Aquifer* (San Pedro Study) marked a milestone. This publication is noteworthy in that it is a first-ever binationally prepared, fully bilingual aquifer assessment, and because it was subject to peer review on both sides of the border. Also noteworthy is the framework for cooperation that has guided the team’s multi-disciplinary and trans-disciplinary collaborative assessment work. Signed on August 19, 2009, IBWC’s “Joint Report of the Principle Engineers Regarding the Joint Cooperative Process United States-Mexico for the Transboundary Aquifer Assessment Program” (Cooperative Framework) took considerable time to develop. The successful ongoing collaboration confirms the value of the time spent at the front-end to develop the Cooperative Framework. The team was able to persevere despite uncertain and very limited funding and the challenges of working in different languages and across an international border. I believe strongly that the Cooperative Framework can serve as a model for both transboundary water studies across the globe, whether or not focused on groundwater.

By way of background, TAAP got its start on the U.S. side with the signing of U.S. Public Law 109-448, the Transboundary Aquifer Assessment Act, in late 2006. I had the honor of serving as the sole non-federal witness at the May 2006 House of Representatives subcommittee hearing on the proposed legislation. The Act articulated U.S. interest in engaging in

binational aquifer assessments of specified priority aquifers. While the Act indicated that IBWC would be consulted “as appropriate”, it soon became clear that IBWC involvement would be central to development of the type of assessment authorized by the Act. (For more information on the IBWC, including the Commissioners and staff for the U.S. and Mexican sections, see ibwc.gov and cila.sre.gov.mx/cilanorte.)

The Cooperative Framework establishes that the binational program will be called the Transboundary Aquifer Assessment Program and that the IBWC will serve as the Binational Coordinating Agency. It confirms that the U.S. and Mexican sections are aware of the value of developing an understanding of the aquifers used by both countries. The Cooperative Framework acknowledges the need to develop a team of binational experts to assess aquifers, exchange data, and if necessary, develop new datasets. The document states that the “IBWC, under this joint cooperative process, will provide the framework for coordination of binational assessment activities conducted by U.S. and Mexican agencies, universities, and others participating in the program.” ... “to improve the knowledge base of transboundary aquifers between the United States and Mexico”. Additional key provisions include assuring that both countries concur on transboundary aquifer assessment activities and specifying binational technical advisory committees for each identified transboundary aquifer. The IBWC was named as the official repository for binational project reports to be published in Spanish and English. Importantly, IBWC is responsible for developing a joint program and for determining whether a proposed aquifer study is in the interest of both countries. The IBWC also coordinates with agencies for both countries in defining the scope of the assessment and facilitating agreement on work plans. However, the Cooperative Framework specifies that “each country will be responsible for any costs on projects conducted in its territory, in addition to selecting the participants and consultants to carry out the studies in that country. Each country may contribute to costs for work done in the other country, and the IBWC will coordinate any flow of funds across the border.” The six principles of agreement, which appear toward the end of the three-page document, make it clear



Reflections: On a Busy Spring

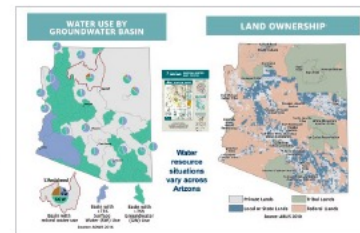
by Sharon B. Megdal
07/07/2023

It is July, more than three months since my last *Reflections*, which was written from the UN Water Conference on World Water Day. The reason for the gap: an overabundance of work-related activities. Teaching, project work, engagement and speaking activities, media interviews, and more have kept me very busy.

Informing audiences of many kinds about our water situation has always been meaningful for me. Interest in understanding the complicated and uncertain implications to Arizona of low Colorado River flows has never been higher. Groundwater issues are of heightened interest as well. Whether the audience consists of students in my graduate course “Water Policy in Arizona and Semi-arid Regions”, community groups, conference/workshop attendees (including international), and/or the media, it’s always necessary to provide sufficient context and nuance. Though I have been complimented for explaining complex water issues concisely, I find it increasingly difficult to deliver quick summaries and explanations. Uneven impacts across geographic regions, across jurisdictions, and across and among water using sectors make generalizations impossible. Two examples drive this home.

The first relates to the impacts of Colorado River cutbacks. Statements like “Arizona’s priority is junior to that of California” and “deliveries of Colorado River water to Arizona agriculture have been cut” must be corrected. While it is true that Central Arizona Project (CAP) water is junior to California’s Colorado River water deliveries, not all Colorado River water used by Arizona entities and jurisdictions, including Native Nations, is junior to California’s. Moreover, within the Central Arizona Project’s three-county service area (Maricopa, Pinal, and Yuma Counties), different water-using groups have been assigned different priorities, with agricultural CAP water deliveries generally assigned low priority. Outside of the CAP service area, agriculture may have high priority water rights. Many audiences, including news media from across the world, need assistance in understanding these complexities. More than ever, I am spending considerable time providing background. Showing maps can help, so I often use maps of water use and land ownership from the WRRC’s [Water Map Poster](#) to drive home the point that situations vary considerably across Arizona.

The second example relates to the early June release by the Arizona Department of Water Resources (ADWR)



Selected maps from the WRRC Arizona Water Map Poster



Reflections: Testifying on Reauthorization of the Transboundary Aquifer Assessment Program

Images: Subcommittee on Water, Wildlife and Fisheries legislative hearing, Oct. 25, 2023



by Sharon B. Megdal
10/27/2023

On October 25, 2023, I had the honor of presenting testimony on H.R. 5874 at the U.S. House of Representatives Committee on Natural Resources, Subcommittee on Water, Wildlife and Fisheries. H.R. 5874, introduced by Arizona District 6 Representative Juan Ciscomani, amends the United States-Mexico Transboundary Aquifer Assessment Act by reauthorizing the United States-Mexico transboundary aquifer assessment program. In addition, the bill, co-sponsored by New Mexico District 1 Representative Melanie Stansbury, modifies a restriction on designation of additional transboundary aquifers along the border shared by Arizona and the state of Sonora, Mexico.

The subcommittee heard several bills. First, House subcommittee members, along with the bills' sponsors, had the opportunity to offer remarks. Then each of the invited witnesses had five minutes to comment on one or more of the bills, after which the witnesses were available to answer questions. Prior to the hearing, I submitted written testimony, from which I drew my five minutes of strictly timed oral testimony.

In his remarks at the [subcommittee legislative hearing](#), Representative Ciscomani noted that water security is on the top of Arizonans' minds and underscored the importance of groundwater to communities along the border, many of which are rural and underserved. He highlighted the transboundary aquifer assessment program's role in assisting communities shape their water futures.

Representative Jim Kolbe (1942–2022), who represented Southern Arizona in Congress from 1985 to 2007, was the House sponsor of the bill to establish a transboundary aquifer assessment program. Representative Kolbe invited me to testify in May 2006 on H.R. 469, which was identical to the Senate bill introduced by Senators Jeff Bingaman of New Mexico and Jon Kyl of Arizona. Representative Raúl Grijalva (District 7), who has represented Arizona's border communities since 2003 and serves as House Natural Resources Committee Ranking Member, has likewise advanced the program.

I reflected on my first experience delivering oral testimony to a congressional subcommittee in my early 2007 essay, [Front-Row View of Federal Water Lawmaking Shows Process Works](#). This latest opportunity to offer testimony on the program prompted me to reflect on the value of the program. What follows is the essence of my submitted written H.R. 5874 testimony. I omit the opening and closing remarks of thanks and the screenshot of the bulletin on the Binational Study of the Transboundary San Pedro Aquifer that was appended to my written testimony. It contains a summary of what this program has accomplished and where it is heading. I am proud to have worked on this cooperative binational program since its inception. I hope you'll read on to become familiar with the Transboundary Aquifer Assessment Program and how the partners are working strategically to foster understanding of the characteristics of shared aquifers. I invite you to email me comments and/or questions at smegdal@arizona.edu.

Directly from the testimony of Sharon B. Megdal with respect to H.R. 5874 dated October 25, 2023:

Background

Like elsewhere in the Southwest – and the Nation – water security and reliability are critical concerns along the border shared by the United States and Mexico. Along the border, groundwater is a particularly important source of water for many communities, and it is the only source for some. Due to its invisibility, assessment of groundwater quantity and quality are needed. Characterizing groundwater conditions and aquifer properties will enable communities along the border to understand their water supply conditions and the implications of their water utilization. Assessments enable more informed decision making by water users, water managers, and policy makers at multiple levels.

The original legislation authorizing the Transboundary Aquifer Assessment Program, codified as P.L. 109-448, became law in late 2006. It authorized the Secretary of the Interior, through the U.S. Geologic Survey (USGS), to collaborate with the states of Arizona, New Mexico and Texas, the country of Mexico, and others to characterize priority transboundary aquifers. The Act established a partnership between the USGS and the federally authorized water resources research institutes per the Water Resources Research Act of 1964, as amended, for the participating states. The University of Arizona Water Resources Research Center, for which I serve as Director, is the federally authorized water institute for Arizona, with the New Mexico Water Resources Research Institute at New Mexico State University and the Texas Water Resources Institute at Texas A&M University being the other two participating university partners. I had the honor of providing testimony at the May 2006 House hearing on the original authorization, H.R. 469 at the time, and I have been involved in implementing the program ever since its approval. This testimony reflects this involvement, along with perspectives gained from my professional academic and non-academic work on groundwater policy and management that extends beyond 30 years.

Aquifers contain the groundwater on which many communities across the country depend. Because groundwater is not visible or accessible like river water, assessments are necessary to characterize the water quantity and quality of the resource, including the rate at which groundwater is being depleted and recharged. Many communities along our shared border with Mexico rely on groundwater. Current research has established that close to 30 aquifers along this border can be considered transboundary. The national frameworks of the United States and Mexico for managing groundwater are quite different. How states and communities within the United States manage groundwater varies considerably. The Transboundary Aquifer Assessment Program authorized by P.L. 109-448 has enabled collaborative research on groundwater and the aquifers that hold it, along with binational dialogue, which has contributed considerably to developing a common understanding of this critically important water resource. With sound, verifiable information in hand, water users, water managers, and policy makers are better equipped to make decisions to support the long-term viability of their economies and communities along the border.

An Overview of Transboundary Aquifer Assessment Program Efforts to Date

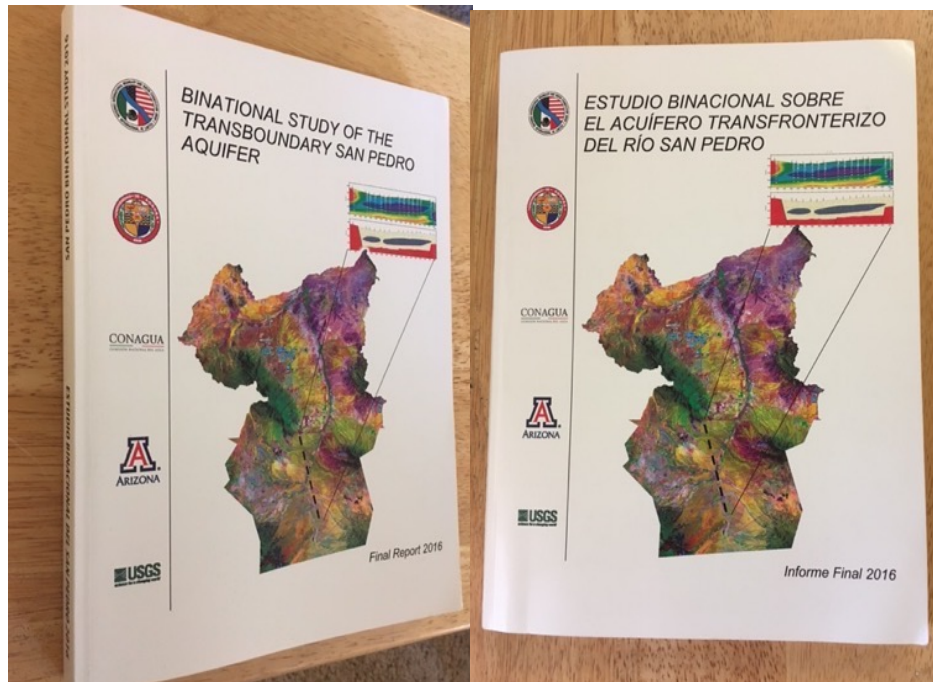
The Transboundary Aquifer Assessment Program has focused on the four priority aquifers specified in P.L. 109-448, which are shown on the map on the right. The map can be accessed at <https://webapps.usgs.gov/taap/index.html>.

Given the program's focus on internationally shared aquifers, the







San Pedro Report completed in 2016

Santa Cruz Report nearing finalization



THE BINATIONAL STUDY OF THE TRANSBOUNDARY SAN PEDRO AQUIFER

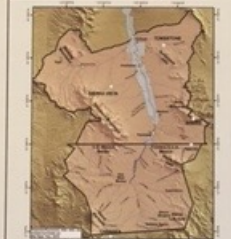
EL ESTUDIO BINACIONAL SOBRE EL ACUÍFERO TRANSFRONTERIZO SAN PEDRO

The Transboundary Aquifer Assessment Program (TAAP) is a joint effort between Mexico and the United States to evaluate shared aquifers. Under this program, scientists from each country collaborate on producing binational studies on shared waters. The Mexican and U.S. Principal Engineers of the International Boundary and Water Commission (IBWC) signed the "Joint Report of the Principal Engineers Regarding the Joint Cooperative Process United States-Mexico" for the TAAP. This IBWC "Joint Report" serves as the framework for coordination and dialogue to implement these studies.

El Programa de Evaluación de Acuíferos Transfronterizos es un esfuerzo conjunto entre México y Estados Unidos para evaluar acuíferos compartidos. Bajo este programa, científicos de cada país colaboran para producir estudios binacionales sobre aguas compartidas. Los Ingenieros Principales de la sección mexicana y estadounidense de la Comisión Internacional de Límites y Aguas (CILA) firmaron el "Informe Común Referente al Proceso de Cooperación Conjunta México-Estados Unidos Para El Programa de Evaluación de Acuíferos Transfronterizos". Este "Informe Común", sirve como marco de referencia en la coordinación y diálogo para la implementación de estos estudios.

The San Pedro Aquifer



Acuífero del Río San Pedro

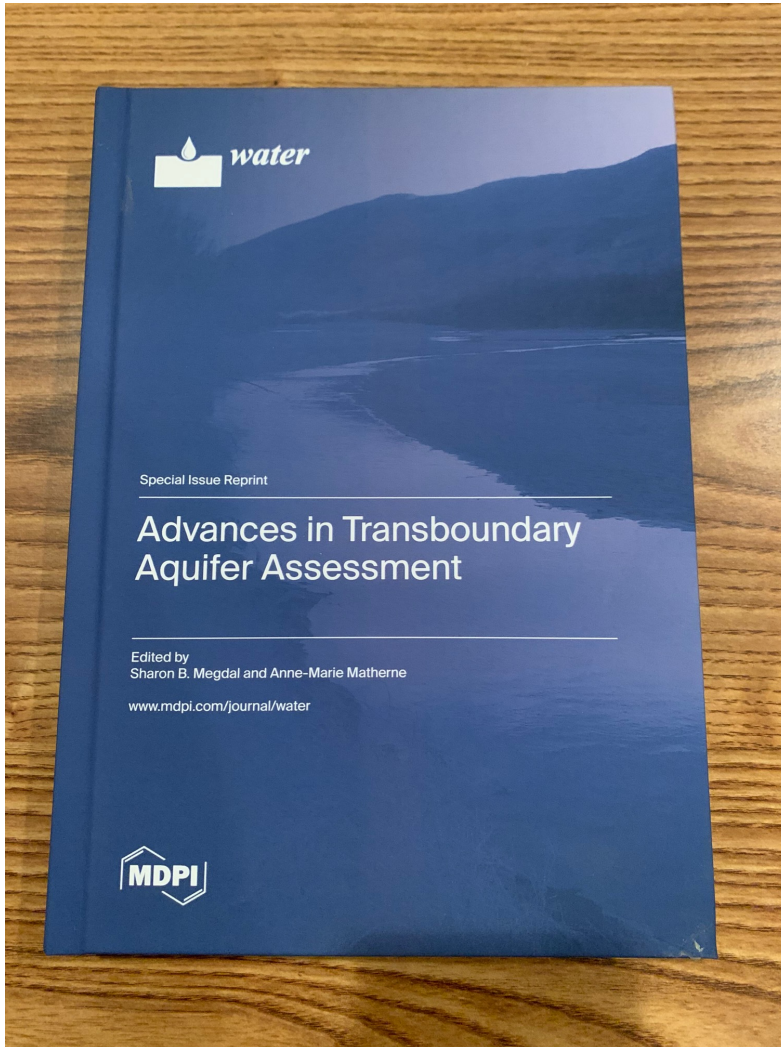
El Estudio Binacional sobre el Acuífero Transfronterizo San Pedro es uno de los logros principales de este esfuerzo conjunto. Ambos países contribuyeron con conocimiento científico y datos acerca del clima, geología, tipo, cobertura y uso de suelo e hidrología. El estudio compila y crea una base de datos de información científica e identifica datos faltantes e información que necesita ser actualizada en fases subsecuentes.

Full report:
https://ibwc.gov/EMD/reports_studies.html#WQ_Reports

Informe completo:
www.cila.gob.mx/sa/ebastrip2016.pdf

For more information, please visit:
cila.sre.gob.mx/cilanorte
IBWC.gov
wrrc.arizona.edu/TAAP

Para más información por favor visite:
cila.sre.gob.mx/cilanorte
IBWC.gov
wrrc.arizona.edu/TAAP



Contents

About the Editors vii

Preface to "Advances in Transboundary Aquifer Assessment" ix

Anne-Marie Matherne and Sharon B. Megdal
Advances in Transboundary Aquifer Assessment
Reprinted from: *Water* 2023, 15, 1208, doi:10.3390/w15061208 1

Khafi Weekes and Gail Krantzberg
Twenty-First Century Science Calls for Twenty-First Century Groundwater Use Law: A Retrospective Analysis of Transboundary Governance Weaknesses and Future Implications in the Laurentian Great Lakes Basin
Reprinted from: *Water* 2021, 13, 1768, doi:10.3390/w13131768 9

Jacob D. Petersen-Perlman, Tamee R. Albrecht, Elia M. Tapia-Villaseñor, Robert G. Varady and Sharon B. Megdal
Science and Binational Cooperation: Bidirectionality in the Transboundary Aquifer Assessment Program in the Arizona-Sonora Border Region
Reprinted from: *Water* 2021, 13, 2364, doi:10.3390/w13172364 31

Elia M. Tapia-Villaseñor and Sharon B. Megdal
The U.S.-Mexico Transboundary Aquifer Assessment Program as a Model for Transborder Groundwater Collaboration
Reprinted from: *Water* 2021, 13, 530, doi:10.3390/w13040530 51

Holly Brause
Trust, Risk, and Power in Transboundary Aquifer Assessment Collaborations
Reprinted from: *Water* 2021, 13, 3350, doi:10.3390/w13233350 71

José Ismael Minjárez Sosa, Grisel Alejandra Gutiérrez Angamea, Rogelio Monreal, Francisco Javier Grijalva Noriega and Elia M. Tapia-Villaseñor
Hydrogeomorphologic Mapping of the Transboundary San Pedro Aquifer: A Tool for Groundwater Characterization
Reprinted from: *Water* 2022, 14, 906, doi:10.3390/w14060906 85

Eylon Shamir, Elia M. Tapia-Villaseñor, Mary-Belle Cruz-Ayala and Sharon B. Megdal
A Review of Climate Change Impacts on the USA-Mexico Transboundary Santa Cruz River Basin
Reprinted from: *Water* 2021, 13, 1390, doi:10.3390/w13101390 97

Elia M. Tapia-Villaseñor, Eylon Shamir, Mary-Belle Cruz-Ayala and Sharon B. Megdal
Assessing Groundwater Withdrawal Sustainability in the Mexican Portion of the Transboundary Santa Cruz River Aquifer
Reprinted from: *Water* 2022, 14, 233, doi:10.3390/w14020233 115

Scott Ikard, Andrew Teeple and Delbert Humberson
Gradient Self-Potential Logging in the Rio Grande to Identify Gaining and Losing Reaches across the Mesilla Valley
Reprinted from: *Water* 2021, 13, 1331, doi:10.3390/w13101331 131

Jeff D. Pepin, Andrew J. Robertson and Shari A. Kelley
Salinity Contributions from Geothermal Waters to the Rio Grande and Shallow Aquifer System in the Transboundary Mesilla (United States)/Conejos-Médanos (Mexico) Basin
Reprinted from: *Water* 2021, 14, 33, doi:10.3390/w14010033 155

Ana Cristina Garcia-Vasquez, Alfredo Granados-Olivas, Zohrab Samani and Alexander Fernald
Investigation of the Origin of Hueco Bolson and Mesilla Basin Aquifers (US and Mexico) with Isotopic Data Analysis
Reprinted from: *Water* 2022, 14, 526, doi:10.3390/w14040526 179

Andrew J. Robertson, Anne-Marie Matherne, Jeff D. Pepin, Andre B. Ritchie, Donald S. Sweetkind and Andrew P. Teeple et al.
Mesilla/Conejos-Médanos Basin: U.S.-Mexico Transboundary Water Resources
Reprinted from: *Water* 2022, 14, 134, doi:10.3390/w14020134 197

Rosario Sanchez and Laura Rodriguez
Transboundary Aquifers between Baja California, Sonora and Chihuahua, Mexico, and California, Arizona and New Mexico, United States: Identification and Categorization
Reprinted from: *Water* 2021, 13, 2878, doi:10.3390/w13202878 233


Rocky Talchabhadel, Helene McMillan, Santosh S. Palmate, Rosario Sanchez, Zhuping Sheng and Saurav Kumar
Current Status and Future Directions in Modeling a Transboundary Aquifer: A Case Study of Hueco Bolson
Reprinted from: *Water* 2021, 13, 3178, doi:10.3390/w13223178 281

Alex Mayer, Josiah Heyman, Alfredo Granados-Olivas, William Hargrove, Mathew Sanderson and Erica Martinez et al.
Investigating Management of Transboundary Waters through Cooperation: A Serious Games Case Study of the Hueco Bolson Aquifer in Chihuahua, Mexico and Texas, United States
Reprinted from: *Water* 2021, 13, 2001, doi:10.3390/w13152001 301

Ashley E. P. Atkins, Saeed P. Langarudi and Alexander G. Fernald
Modeling as a Tool for Transboundary Aquifer Assessment Prioritization
Reprinted from: *Water* 2021, 13, 2685, doi:10.3390/w13192685 319

Article

The U.S.-Mexico Transboundary Aquifer Assessment Program as a Model for Transborder Groundwater Collaboration

Elia M. Tapia-Villaseñor ^{1,*}  and Sharon B. Megdal ²

Article

Assessing Groundwater Withdrawal Sustainability in the Mexican Portion of the Transboundary Santa Cruz River Aquifer

Elia M. Tapia-Villaseñor ^{1,*}, Eylon Shamir ², Mary-Belle Cruz-Ayala ³ and Sharon B. Megdal ³

Review

A Review of Climate Change Impacts on the USA-Mexico Transboundary Santa Cruz River Basin

Eylon Shamir ^{1,*}, Elia M. Tapia-Villaseñor ², Mary-Belle Cruz-Ayala ³ and Sharon B. Megdal ⁴

Article



Hydrogeomorphologic Mapping of the Transboundary San Pedro Aquifer: A Tool for Groundwater Characterization

José Ismael Minjárez Sosa, Grisel Alejandra Gutiérrez Anguamea, Rogelio Monreal, Francisco Javier Grijalva Noriega and Elia M. Tapia-Villaseñor ^{*}

https://www.mdpi.com/journal/water/special_issues/transboundary_aquifer

Draft USGS/WRRI Joint 5-year Strategic Plan, FY23-27

Five tasks, with subtasks identified.

1. Stakeholder Engagement and Capacity Building
 1. Binational workshop
 2. Stakeholder mapping
 3. Stakeholder engagement activities
2. Socio-Economic Context, Governance, and Policy
 1. Basic demographics of border communities
 2. The importance of groundwater to regional economic activities
 3. Cultural beliefs and practices related to shared water resources
 4. Governance structures or frameworks and relevant policy
3. Binational Groundwater Atlas: Data Management, Mapping, and Visualization 
4. Aquifer prioritization and vulnerability assessment
5. Hydrologic Studies to Understand Water Availability Challenges Facing 
Transboundary Aquifers – Stressors from Population, Industry, Agriculture, Drought, and Climate Variability
 1. Improve understanding of water availability and risks to sustainable resource development

Binational modeling vs single-country modeling of a transboundary aquifer

Focus of WRRC efforts (Team members: Megdal, Elia Tapia and Eylon Shamir)

1. Collaborative efforts identified through the TAAP Cooperative Framework
 1. Participate in the completion of the Binational Study of the Transboundary Santa Cruz Aquifer (Santa Cruz Study)
 2. Participate in binational and regional TAAP meetings, workshops, roundtables, focus groups, etc.
2. Hydrologic and hydrogeologic characterizations
 1. Transboundary San Pedro and Santa Cruz data collection and monitoring efforts
 2. Assessment of climate variability and water resources management impact on groundwater availability
3. Transboundary San Pedro and Santa Cruz data collection and monitoring efforts
 1. Inventory of available science, GIS layers, and hydro-meteorological data
4. Socioeconomic characterization of selected border communities and examination of modes of governance
 1. Basic demographics of border communities and the importance of groundwater to local and regional economic activities
5. Stakeholder engagement
 1. Develop a map of key stakeholders involved in transboundary groundwater activities and decision-making
 2. Stakeholder engagement activities

TAAP Reauthorization Legislation



118TH CONGRESS
1ST SESSION

H. R. 5874

To amend the United States-Mexico Transboundary Aquifer Assessment Act to reauthorize the United States-Mexico transboundary aquifer assessment program.

IN THE HOUSE OF REPRESENTATIVES

OCTOBER 3, 2023

Mr. CISCOMANI (for himself and Ms. STANSBURY) introduced the following bill, which was referred to the Committee on Natural Resources

A BILL

To amend the United States-Mexico Transboundary Aquifer Assessment Act to reauthorize the United States-Mexico transboundary aquifer assessment program.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the “Transboundary Aquifer Assessment Program Act” or the “TAAP Act”.

SEC. 2. REAUTHORIZATION OF TRANSBOUNDARY AQUIFER ASSESSMENT PROGRAM.

(a) DESIGNATION OF PRIORITY TRANSBOUNDARY AQUIFERS.—Section 4(c)(2) of the United States-Mexico

2

1 Transboundary Aquifer Assessment Act (42 U.S.C. 1962
2 note; Public Law 109–448) is amended by striking “New
3 Mexico or Texas” and inserting “New Mexico, Texas, or
4 Arizona (other than an aquifer underlying Arizona and
5 Sonora, Mexico, that is partially within the Yuma ground-
6 water basin designated by the order of the Director of the
7 Arizona Department of Water Resources dated June 21,
8 1984)”.

9 (b) AUTHORIZATION OF APPROPRIATIONS.—Section
10 8(a) of the United States-Mexico Transboundary Aquifer
11 Assessment Act (42 U.S.C. 1962 note; Public Law 109–
12 448) is amended by striking “fiscal years 2007 through
13 2016” and inserting “fiscal years 2025 through 2035”.

14 (c) SUNSET OF AUTHORITY.—Section 9 of the United
15 States-Mexico Transboundary Aquifer Assessment Act (42
16 U.S.C. 1962 note; Public Law 109–448) is amended by
17 striking “enactment of this Act” and inserting “enactment
18 of the Transboundary Aquifer Assessment Program Act”.

○

•HR 5874 IH

Testimony before
U.S. House of Representatives
Committee on Natural Resources
Subcommittee on Water, Wildlife and Fisheries
With respect to H.R. 5874
To amend the United States-Mexico Transboundary Aquifer Assessment Act
to reauthorize the United States-Mexico transboundary aquifer assessment
program.

Written Testimony of Sharon B. Megdal, Ph.D.
Director, Water Resources Research Center, A Cooperative Extension Center
Faculty Member, Department of Environmental Science and Cooperative Extension
The University of Arizona, Tucson, Arizona

October 25, 2023

November 9, 2023

Mr. Thomas Shipman, Jr.
thomas.shipman@mail.house.gov
U.S. House of Representatives
Committee on Natural Resources
Subcommittee on Water, Wildlife and Fisheries
Washington, DC 20513

Sent via email:

Dear Mr. Shipman,

Attached to this letter please find responses to the questions transmitted via letter dated October 30, 2023, from Representative Cliff Bentz, Chairman, Subcommittee on Water, Wildlife and Fisheries.

I thank Representative Ciscomani for these questions and Chairman Bentz for the opportunity to provide these written responses. Please let me know if you have any questions about these responses.

Sincerely,

Sharon B. Megdal, Ph.D.
Director, University of Arizona Water Resources Research Center
Professor, Department of Environmental Science
C.W. and Modene Neely Endowed Professor
Distinguished Outreach Professor

<https://wrrc.arizona.edu/publication/reflections-testifying-reauthorization-transboundary-aquifer-assessment-program>

Appropriations for all of the US TAAP efforts through FY2023 (WRRC has received 1/6 of the amount listed)

Federal TAAP Appropriations through FY2023	
FY2008	\$~500,000
FY2009	\$500,000
FY2010	\$1,000,000
FY2016	\$1,000,000
FY2017	\$1,000,000
FY2018	\$1,000,000
FY2019	\$1,000,000
FY2020	\$1,000,000
FY2021	\$1,000,000
FY2022	\$1,000,000
FY2023	\$1,000,000
TOTAL	\$10,000,000

Some complementary efforts

TRANSBOUNDARY AQUIFERS : CHALLENGES AND THE WAY FORWARD

TOPIC 2 : GOVERNANCE OF TBAS: STRENGTHENING COOPERATION

TOPIC 2/Paper 5

Reaching Groundwater Agreements on the Border Between Mexico and the United States: Science and Policy Fundamentals

Sharon B. Megdal¹, Stephen Mumme², Roberto Salmon³, Rosario Sánchez⁴, Elia M. Tapia-Villaseñor⁵, Mary-Belle Cruz Ayala⁶, and Óscar Ibañez⁶

Abstract

<https://unesdoc.unesco.org/ark:/48223/pf0000383775/PDF/383775eng.pdf.multi>

OPEN ACCESS

Water Economics and Policy, (2023) 2371007 (11 pages)

© The Author(s)

DOI: 10.1142/S2382624X23710078

 World Scientific
www.worldscientific.com

Policy Nook

Published 25 January 2024

Crafting Binational Groundwater Agreements: Preconditions for Progress Along the Mexico-U.S. Boundary

Stephen Mumme, Sharon B. Megdal*, Rosario Sanchez, Holly Brause, Roberto Salmón, Elia Tapia-Villaseñor, Oscar Ibañez, Carlos de la Parra and Mary-Belle Cruz Ayala
*smegdal@arizona.edu

<https://www.worldscientific.com/doi/epdf/10.1142/S2382624X23710078>

Additional

DRAFT – Not for citation or circulation – Prepublication version of chapter in *Handbook of Water Diplomacy*, Shafiqul Islam, Kevin Smith, Martina Klimes, and Aaron Salzberg, eds., Routledge Press.

Factors that Contribute to Successful Diplomatic Outcomes: Case Study of the Colorado River Basin Cross-boundary Institution

Sharon B. Megdal
[ORCID.org/0000-0001-7781-297X](https://orcid.org/0000-0001-7781-297X)

Abstract

This case study provides insights regarding factors that contribute to successful cross-boundary diplomatic outcomes in the Colorado River Basin. The highlighted factors are based on the author's study of and participation in water policy and management within the Colorado River Basin, along with observations of other areas. The Colorado River, which provides water to seven states in the western United States, two states in Mexico, and several Native Nations, has experienced stressed hydrologic conditions since the turn of the century. These conditions have often required difficult negotiations on matters related to sharing the burden of reduced Colorado River water deliveries. Established by treaty, the International Boundary and Water Commission has demonstrated its ability to negotiate binding agreements to share shortages and address environmental concerns. Though the case study concentrates on the structure and processes of the International Boundary and Water Commission regarding Colorado River Basin transboundary diplomacy, the enumerated contributing factors to successful diplomatic outcomes have broad applicability in terms of community scale and conditions.

The seven factors:

- A functioning mechanism for cooperation, including knowledge co-production
- Mutual respect contributing to trust
- Involvement of interested parties (stakeholders)
- Good communication
- Persistence and Patience
- Eating with your partners
- Leadership

Will speak to matters related to transboundary (ground)water, the IBWC, and the Colorado River Basin at the 10th World Water Forum being held this May in Bali.

Opportunities and challenges

Opportunities

- Desire to work binationally
- Greater recognition of the role of groundwater
- Increased stakeholder engagement



Binational Workshop November 2009

Challenges

- Funding
 - Inconsistent across the countries
 - Inconsistent over time
 - Level and predictability
- Coordinating schedules

AZ-Sonora Meeting. June 2023, Nogales AZ



Binational Summit on Groundwater at the United States-Mexico Border. April 2019

Thank you!

smegdal@arizona.edu