

Workshop Report
Developing a Work Plan for the Santa Cruz and San Pedro Aquifers
Transboundary Aquifer Assessment Program – Arizona/Sonora
November 3-4, 2009

Water Resources Research Center, University of Arizona

Executive Summary

The University of Arizona's Water Resources Research Center and the United States Geological Survey's Arizona Water Science Center hosted a workshop in Tucson, Arizona as part of the U.S. – Mexico Transboundary Aquifer Assessment Program. The primary objective was to review progress of the Arizona-Sonora component of the U.S.-Mexico Transboundary Aquifer Assessment Program (TAAP-A/S) and confirm or modify priorities in the draft work plan that will guide assessment of the Santa Cruz and San Pedro aquifers. This workshop brought together stakeholders from both sides of the border, including federal, state, and local agencies, non-governmental organizations, and university researchers. Following an initial afternoon of presentations, breakout groups formed to discuss in detail assessment activities for the Santa Cruz and San Pedro aquifers, based on a draft plan prepared and presented by the workshop organizers. This report synthesizes observations made that have led to a modified work plan.

The workshop resulted in the following recommendations for continued assessment of the Santa Cruz and San Pedro aquifers:

- Numerous studies, models, and reports exist for physical characteristics of the aquifers on each side of the border; however, relatively little combined work exists that encompasses both U.S. and Mexican sides of the aquifers.
- There is a need for additional social and institutional assessment of the aquifers, including decision-making and regulation.
- Cross-border coordination is crucial to successful assessment of shared aquifer resources; the preparatory phase of TAAP-A/S has set the stage for such coordination.
- Additional funding support is necessary to implement activities identified in the work plan.



Figure 1. Location of upper Santa Cruz and San Pedro

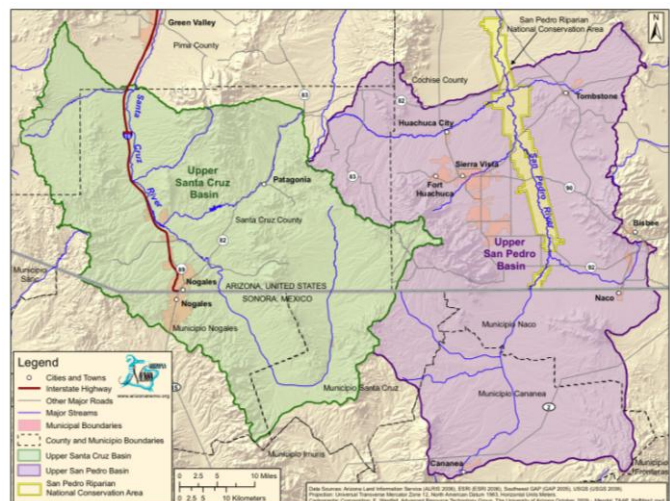


Figure 2. Santa Cruz and San Pedro aquifers

Background

U.S. Public Law 109-448 created the Transboundary Aquifer Assessment Program (TAAP) to assess priority transboundary aquifers between the U.S. states of Arizona, New Mexico, and Texas, and adjoining Mexican states. The TAAP-Arizona/Sonora (TAAP-A/S) coordinating team, in conjunction with local and regional counterparts, has been working towards the definition of a work plan for assessment of the Santa Cruz and San Pedro aquifers. Preliminary steps initiated in 2007 include outreach and identification of stakeholders from both countries, the creation of binational working groups to prioritize potential activities, coordination with the International Boundary and Water Commission, and detailing provisional activities in a draft work plan for the two aquifers.

The goals of the workshop, titled “Developing a Work Plan for the Assessment of the Santa Cruz and San Pedro Aquifers,” were to review progress of the Arizona-Sonora component of the TAAP and confirm or modify priorities in the draft work plan to guide assessment activities of the aquifers. The workshop brought together a unique set of stakeholders with specific knowledge in the aquifers under discussion. Presentations were made by representatives of the following agencies and/or organizations:

- Mexican National Water Commission (Comisión Nacional del Agua)
- United States Geological Survey
- UNESCO Internationally Shared Aquifer Resources Management (ISARM) Programme
- International Boundary and Water Commission-U.S. Section
- International Boundary and Water Commission-Mexican Section
- Sonoran State Water Commission (Comisión Estatal del Agua- Sonora)
- Arizona Department of Water Resources, Santa Cruz Active Management Area
- Upper San Pedro Partnership
- University of Arizona

Workshop Summary

The first day of the workshop was dedicated to description of the issues related to the aquifers from the perspectives of multiple agencies working on both sides of the international border. An effort was made to sequence speakers of similar levels of authority over groundwater management and assessment from Mexico and the U.S. Initial presentations for the late afternoon session were made by the Principal Engineers of the Mexico and U.S. Sections of the International Boundary and Water Commission. Subsequently, federal agencies as well as state and local-level interests provided their perspectives on the status of the two aquifers and the communities which they support.

For the second day of the workshop, different aspects of the draft work plan and overall work plan goals were reviewed by the TAAP-A/S coordinators. Participants then divided into breakout groups depending on their particular geographical area of knowledge or experience (Santa Cruz or San Pedro basins) and were asked to discuss and refine the draft work plan in respect to one basin or the other. Breakout groups gave particular attention to future assessment activities, and provided input on how to best to tailor goals for scientific data collection. Following these discussions, breakout group representatives reported back to workshop participants the most salient points of each group’s discussion.

As the majority of workshop participants tended to be more knowledgeable in respect to the Santa Cruz aquifer region, two breakout groups were dedicated to discussing issues regarding that area, and one group focused on the San Pedro area. The breakout group exercise illustrated that within the three different groups, similar themes were discussed and a concise set of issues were identified as being priorities for assessment activities.

The workshop agenda can be found attached to this document. The agenda, along with all presentations can also be found at: <http://aq.arizona.edu/azwater/taap/agenda>

Breakout Group Report Summaries

Santa Cruz Breakout Group 1

Breakout Group 1 organized their discussion under five themes: Monitoring, Recharge, Natural and Anthropogenic Effects, Modeling, and Management and Policy. Within these areas, specific ideas were expressed regarding proposed assessment activities and coordination processes.

- Increased or secured (funding-wise) monitoring sites, such as currently functioning or potentially new surface flow gages.
 - It is important to continue monitoring at the Lochiel and Nogales (Buena Vista) gages that may be in danger due to funding shortages. Also, the El Cajon gage in Mexico, which is currently inactive (though has been active in the past) would provide important data on surface flows near the southernmost extent of the Santa Cruz river. Another important site for surface flow measurement is the Nogales Wash.
 - Improved precipitation data and increased precipitation monitoring networks would assist with flood prediction management. It is also needed as regional climate monitoring radar does not provide adequate coverage for the Ambos Nogales area, due to topographic constraints.
 - Improved municipal-use well data from the city of Nogales, Sonora via macro and micro metering initiatives are needed for the municipal area. Currently household-level meters are being installed in certain neighborhoods. Gages are also being installed on supply tanks located at upper elevation locations around the city. Pumpage data from supply wells is currently being collected, though meters are not being installed to consistently collect readings.
- The rate of recharge and coordinated monitoring efforts of such are important for a thorough understanding of the binational watershed.
 - Mexico and the U.S. assume different amounts and conduits for subsurface flow across the border. Increased geophysical and chemical studies may assist in clarifying this issue. Sampling which leads to this analysis should be coordinated across the border.
- The effect of recently installed gabions in Nogales, Sonora for flood control on recharge is of interest to many regional stakeholders.
- Watershed “health” and status, including riparian and ecosystem health.
 - Sonoran Institute and UNISON have worked together in the past, and continue to collaborate on data collection for riparian area monitoring on both sides of the border. It is understood that a large amount of data currently exists related to riparian health, but the accessibility of this information is not adequate for all stakeholders. Such records need to be cataloged and be made available.
- Refined hydrologic models which transcend the international boundary.
 - Current ADWR models stop at the international border and modeling efforts on the Mexican reach of the Santa Cruz are limited in scope. Measurement units need to be the same across the border, so agreements on data collection formats will need to be arranged. It was also noted that any modeling tool created would need to be in a format that is user-friendly to a wide variety of stakeholders. It was suggested that MODFLOW (the format of many regulatory agency and academic reports) may be too complex for such an audience.
- Cross-border coordination of data collection and monitoring efforts are crucial to utility and application of data.
 - Such data (that which currently exists and that which will be collected) needs to be adequately catalogued. It is understood that a large amount of data has already been collected in various research and monitoring projects in the Upper Santa Cruz basin, yet it must be available and usable for stakeholders. Aside from binational modeling efforts, a binational water budget was also considered an important goal, as it would assist with management decisions.

Santa Cruz Breakout Group 2

Breakout Group 2 created a detailed list of suggested future assessment activities. Many of their suggested projects coincided with issues discussed by the other Santa Cruz breakout group, but there was clear foci of data collection and diffusion, monitoring goals and efforts, and the anthropogenic aspects on the river basin system. The Group also recommended that the work plan be divided into two sections- one for inventory and assessment of currently existing data, and one for recommendations of future activities.

- Increased and refined monitoring of precipitation, pumpage, streamflow, and water quality.
 - The increased use and precise placement of rain gages throughout the Nogales Wash basin was seen as very important, potentially prioritizing manual rather than automated gages due to budget constraints. Continued streamflow measurement at Nogales and Lochiel, as well as rehabilitation and activation of the El Cajon gage in Mexico, are paramount for basin-wide analysis. Support for FOSCR water quality monitoring efforts is important, given the continuity of their data. The effect of check dams and evolving vegetation cover in the Nogales Wash on runoff and infiltration needs to be examined. Also, monitoring wells in both Nogales, Arizona and Nogales, Sonora need to be rehabilitated. Macro-metering efforts by OOMAPAS on distribution points can be supplemented with continuous metering at supply wells and infiltration galleries.
- Analysis of existing and future data sources.
 - The compilation of existing data sources will give TAAP the opportunity to evaluate the temporal and spatial extent of such as well as data gaps and inconsistency. Important outputs may include a binational groundwater model, and up-to-date water budgets from the Ambos Nogales watershed and the larger upper Santa Cruz Basin.

- Diffusion of compiled data and other outputs to a large group of stakeholders, and continued engagement of interested parties.
 - The compilation of data related to the Santa Cruz needs to be made available to a large and diverse set of stakeholders. TAAP could take a lead role as a “clearinghouse” for such data. It was recommended that TAAP conduct or promote hydrologic modeling activities that provide a large amount of useful information to a variety of stakeholders. It was noted that finite element models rather than finite different models may be preferred due to computational requirements, incorporation of surface water data, and ability to focus on key locations. It was also noted that workshop representation was lacking from certain entities. The group suggested continued engagement with the University of Sonora and Sociedad Geológica Mexicana (Mexican Geological Society).

The common theme of the two Santa Cruz breakout groups was that there exist a variety of specific monitoring and analysis activities that are important on a basin-wide scale. There was a general consensus among participants that many of these particular monitoring and assessment tasks would be useful in the formation of regional modeling efforts and creation of water budgets. Yet, as emphasized by Breakout Group 2, the resulting data will need to be available (in terms of access and comprehension) to a broad set of stakeholders.



Figure 3. Santa Cruz breakout group discusses binational work plan and priority assessment activities

San Pedro Breakout Group

The San Pedro Breakout Group included many participants who have been involved with binational-scope and cross-border initiatives for more than 10 years. Thus, their historical understanding of the situation of the upper basin was quite developed. Much of the discussion by the group focused on how the TAAP works across the border, and how it can be expanded and developed not only on a border-wide scale, but also within local communities and specific watersheds. They highlighted the following points:

- There currently exists a solid groundwater model developed for the U.S. side of the aquifer by the USGS and it would be useful for a potential binational model to follow the parameters already defined by the existing model.
- A significant amount of institutional assessment has already been done on both sides of the border, such as studies on management and pricing in Cananea.
- Funding for binational and cross-border assessment projects may be the ultimate hurdle. Many different funding sources and options were discussed, with a focus on Mexican and International agencies. CONACyT (Mexican National Science and Technology Consortium) funding could be garnered via collaboration with UNAM (National Autonomous University of Mexico) or ITSON (Technical Institute of Sonora) and perhaps matched to NSF funding. The GEF (Global Environment Facility) was also suggested as a funding source. Although ISARM-UNESCO is not a funding source, it can assist with finding funds. There may also be potential with renewed IAI funding. CONAGUA and CEA are also seen as primary sources of matching funds for potential TAAP projects, potentially via the Consejo de Cuenca in the Mexican San Pedro Basin.
- Current binational coordination in the Mesilla and Hueco Bolsón aquifers may serve as an example for the San Pedro. Lessons can be learned from their experience, such as data collection protocol, since during recent monitoring activities

data was collected in different formats on different sides of the border and then was difficult to incorporate in a shared database.

The overall theme of the San Pedro Breakout Group discussion revolved around how to make the TAAP-A/S function as a binational-shared initiative, despite the fact that its origins lie in a U.S. federal legislative document. Representatives from Mexico were keen to point out that while they are enthusiastic to work on shared resource issues, the legal framework behind the TAAP does not cross the border, and thus while there are explicit stipulations for how activities must develop on the U.S. side, no such guidelines formally exist for transboundary aquifer assessment by and in Mexico.

Workshop Report Conclusion

The TAAP-A/S workshop, “Developing a Work Plan for the Assessment of the Santa Cruz and San Pedro Aquifers” brought together a wide variety of stakeholders from the U.S. and Mexico to discuss priorities for Santa Cruz and San Pedro aquifer resource assessment. The workshop identified several next steps for TAAP-A/S.

First, although numerous studies, models, and reports exist for the aquifers on each side of the border, additional work by binational teams is required for improved assessment of the aquifers on both sides of the border.

Second, understanding of physical aquifer processes must be complemented by assessment of both countries’ management and policy of groundwater, including laws, institutions, and regulations.

Third, although the preparatory phase of TAAP-A/S builds on other binational initiatives for U.S.-Mexico collaboration, the improved coordination resulting from IBWC/CILA’s role in the program will be indispensable for shared aquifer resource assessment.

Finally, while funding support for TAAP has increased in FY 2010, significant additional resources will be required to meet the objectives identified in the work plan.

Workshop Agenda

**The U.S. - Mexico Transboundary Aquifer Assessment Program Workshop:
Developing a Work Plan for the Assessment of the Santa Cruz and San Pedro Aquifers
Hosted by the University of Arizona Water Resources Research Center
and the United States Geological Survey**

Desert Diamond Casino-Hotel: Tucson, Arizona

November 3 - 4, 2009

Workshop goals: Review progress of the Arizona-Sonora component of the U.S.-Mexico Transboundary Aquifer Assessment Program (TAAP) and confirm or modify priorities in the draft work plan that will guide assessment of the Santa Cruz and San Pedro aquifers.

Tuesday November 3, 2009

- 1:00-1:15 **Welcome and introductions**
- Sharon Megdal, Water Resources Research Center (WRRRC)
 - Natalie Luna, Office of Congressman Raúl Grijalva
- 1:15-2:00 **Setting the stage: overview of TAAP, summary of progress to date (Arizona-Sonora component)**
- Lucas Oroz, National Water Commission of Mexico (CONAGUA)
 - Transboundary Aquifer Assessment Program in Arizona and Sonora — Sharon Megdal, WRRRC, James Callegary, USGS; Christopher Scott, University of Arizona, Udall Center for Studies in Public Policy
 - William Alley, United States Geological Survey (USGS)
- 2:00-3:00 **Perspectives on the Internationally Shared Aquifer Resource Management Programme (ISARM)**
- Raya Marina Stephan, UNESCO/ ISARM
 - Roberto Senci3n, CONAGUA
- 3:15-4:45 **Programs and initiatives with relevance for TAAP San Pedro and Santa Cruz assessment work plan**
(moderated by Prescott Vandervoet, University of Arizona, TAAP-Arizona)
- Binational cooperative framework – Antonio Rasc3n, International Boundary and Water Commission, Mexican Section (CILA)
 - Role of IBWC/CILA in Santa Cruz and San Pedro aquifers – John Merino, International Boundary and Water Commission, U.S. Section (IBWC)
 - USGS role in Arizona groundwater management – Jim Leenhouts, USGS
 - Santa Cruz and San Pedro aquifers in Sonora – Gilberto Celaya, Sonora State Water Commission (CEA-Sonora)
 - Santa Cruz aquifer in Arizona - Alejandro Barcenas, Santa Cruz Active Management Area
 - San Pedro aquifer in Arizona - Holly Richter, Upper San Pedro Partnership
- 4:45-5:30 **Synthesis and discussion**
- Christopher Scott, Udall Center

Wednesday November 4, 2009

- 8:00-9:15 **Thematic overview of TAAP Santa Cruz and San Pedro draft work plan**
(co-moderated by Sharon Megdal, WRRRC and Roberto Senci3n, CONAGUA)
- Opening Remarks – Sharon Megdal, WRRRC and Roberto Senci3n, CONAGUA
 - Binational institutions, management, and policy – Christopher Scott, Udall Center
 - Santa Cruz and San Pedro water balance studies in Mexico – Lucas Oroz, CONAGUA
 - Geophysical, hydrologic, and water quality modeling – James Callegary, USGS
- 9:15-9:30 **Organize breakout groups to review Santa Cruz and San Pedro aquifers work plan**
- Christopher Scott, Udall Center
- 9:45-11:30 **Breakout groups to discuss priorities and specific features of draft work plan**
- Santa Cruz work plan (U.S. and Mexican sides)
 - San Pedro work plan (U.S. and Mexican sides)
- 11:30-12:15 **Report back session, presentation of findings and understandings, recommendations for work plan**
- James Callegary, USGS
- 12:30-1:30 **Buffet lunch, synthesis, identification of next steps**
- Sharon Megdal, WRRRC

Workshop Participant List

<u>Last Name</u>	<u>First Name</u>	<u>Affiliation</u>	<u>Location</u>
Alley	William	USGS	San Diego, California
Alvarez	Hector	CONAGUA	Hermosillo, Sonora
Arenas	Beto	IBWC	El Paso, Texas
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Brott	Emily	Sonoran Institute	Tucson, Arizona
Browning-Aiken	Anne	Udall Center	Tucson, Arizona
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Megdal	Sharon	WRRC	Tucson, Arizona
Merino	John	IBWC	El Paso, Texas

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Oroz	Lucas	CONAGUA	Hermosillo, Mexico
Prichard	Andrea	UA	Tucson, Arizona
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Richter	Holly	USPP	Sierra Vista, Arizona
Robie	Carl	Cochise County	Bisbee, AZ
Sass	Sherry	FOSCR	Tubac, Arizona
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Sprouse	Terry	WRRC	Tucson, Arizona
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Tosline	Deborah	USBOR	Tucson, Arizona
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Vandervoet	Prescott	Udall Center	Tucson, Arizona
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Weather-spoon	Steve	City of Nogales	Nogales, Arizona