The Water Report

Water Rights, Water Quality & Water Solutions in the West

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ACHIEVING SUSTAINABILITY FOR THE UPPER SAN PEDRO RIVER

A NEW PARADIGM FOR THE REGION

by Dave Roberts, Water Strategy Consultant (Phoenix, AZ)

Introduction

The San Pedro River (River) is one of few remaining free-flowing rivers in the southwestern United States. Flowing north from its headwaters in Sonora, Mexico, through Cochise and Pinal Counties in Arizona, the River's riparian corridor supports more than 400 animal species including four that are listed as threatened or endangered under the Endangered Species Act (ESA). The watershed supporting the River's streamflow encompasses more than 4,700 square miles and is often divided into two segments, or sub-basins, by hydrologists and water resource managers—the upper watershed and the lower watershed. The dividing point, referred to as the Narrows, is located north of Benson.

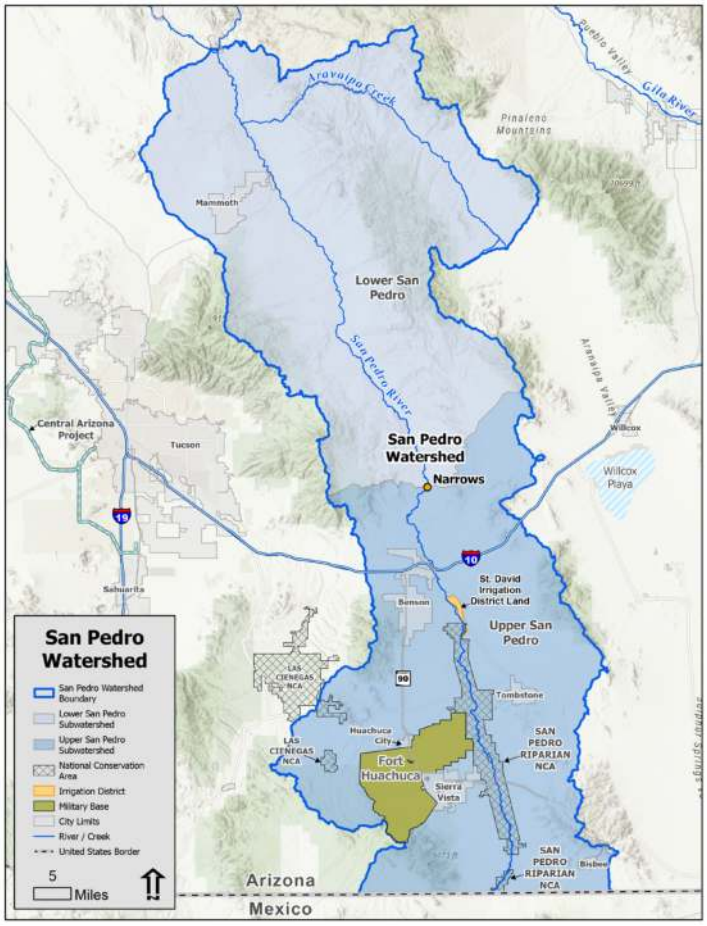

Figure 1. San Pedro Watershed

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The watershed is home to approximately 100,000 residents, most of whom live in the upper watershed in the cities of Bisbee and Sierra Vista, at Fort Huachuca, and in the town of Benson. The upper watershed is also home to two federal reservations—Fort Huachuca (Fort), a military installation established and expanded by President Chester Arthur under Executive Orders 35 and 36 in 1881 and 1883, respectively, and the San Pedro River National Conservation Area (SPRNCA) established by Congress in 1988. The Fort is an important army base; it houses the United States Army Intelligence Center and the Army's Network Enterprise Technology Command. SPRNCA, which lies adjacent to the Fort, was established to protect and enhance the riparian ecosystem along approximately 40 miles of the River generally running north from the Mexican border to just south of Benson. A relatively small agricultural community exists in the upper watershed—the St. David Irrigation Company—while several smaller ranching and farming enterprises operate in the lower watershed.

Water found within the watershed is used for a variety of purposes including domestic, agriculture, mining, livestock, wildlife, and municipal uses supplied by a large number of private water companies. Historically, the River was perennial along its entire length and supported surface water diversions and water rights established for farming, livestock, wildlife, and mining uses. Over time, streamflow in the River has generally decreased and in many areas has become ephemeral, flowing only in response to large precipitation events. Much of this decrease has been attributed to pumping of groundwater in the basin, although changes in climate are believed to be extending and deepening periodic droughts that occur in the watershed. More than 8,000 wells are registered in the watershed in the United States and a large percentage are located adjacent to the River and its tributaries. Most of the higher-capacity wells are located in the upper watershed and are used to supply a copper mine near Cananea, Mexico, and to supply Sierra Vista, Benson, and Fort Huachuca. This concentration of wells has created an extensive cone of depression in groundwater levels.

Water Use and Lawsuits

The effect of pumping wells on surface water in the watershed has been a constant issue and source of litigation throughout the upper San Pedro watershed since the mid-1990s. In large part, SPRNCA was established by Congress to protect the upper riparian corridor, which is supported by the River's streamflow and adjacent shallow groundwater. All four listed species use the SPRNCA riparian corridor. The Fort, Sierra Vista, surrounding communities, and numerous landowners in the region all pump groundwater to support their residences, businesses, and other uses in the region. And, given the close hydrologic connection between groundwater and surface water along the River, it is inevitable that conflict arises over how water is used in the watershed.

LITIGATION CONCERNING THE FORT'S COMPLIANCE WITH THE ESA

In 1991, Congress authorized the expansion of the Fort's mission with the transfer of the military intelligence school from Fort Devens, Massachusetts to the Fort. In preparing for the expansion, the Fort completed an Environmental Impact Statement (EIS) under the National Environmental Policy Act to evaluate the impacts of the expansion on the environment. In 1994 the Center for Biological Diversity (Center) sued the Department of the Army (Department) in federal District Court, alleging the Fort's EIS had failed to adequately assess the cumulative impacts of the Fort's expansion on the River and SPRNCA. The Center claimed that the Fort was the key driver of the economy and population growth in the upper San Pedro region and that increased pumping would eventually dry up the River, just as it did in the neighboring Santa Cruz River. The Center further asked for an injunction and requested that the Fort perform a complete environmental analysis and mitigate any impacts. In response, the Department claimed that the 60-day statute of limitations provision of the 1990 Defense Base Closure and Realignment Act prevented the Center's claims from being granted. In 1995, Judge Alfredo Marquez denied the Center's claim, but made it very clear to the Department that future environmental analyses, including the Fort's compliance with the ESA, must address the cumulative impacts of the Fort's activities on the River and SPRNCA, as well as the adjacent development in the Sierra Vista area.

Since 1995, the Fort has consulted with the United States Fish & Wildlife Service (Service) on multiple occasions to prepare the environmental analyses of its operations. In 1999, 2002, 2007, and 2014, the Service prepared Biological Opinions (BiOp) for the Fort's operations under Section 7 of the ESA. With the release of each BiOp, the Center, along with the Maricopa Audubon Society and the Sierra Club, raised concerns about the impact of the Fort's continuing operations on the endangered species that inhabit SPRNCA's riparian corridor. In 2000, 2005, 2007, and 2020, the Center sued the Department and the Service in federal District Court, citing the insufficiency of each BiOp and mitigation measures the Fort either implemented or failed to implement to protect streamflow and riparian areas within SPRNCA.

Upper San Pedro

Overestimated Benefits

In each instance the District Court agreed with the Center, or the Center and the Department agreed independently, that the BiOps were insufficient, and the effects of the Fort's operations needed to be reanalyzed. Under the most recent decision by the District Court in 2022, Judge Raner Collins ordered the Fort and Service to reinitiate yet another consultation under Section 7 of the ESA. On appeal in 2023, the Ninth Circuit Court of Appeals concluded that the measures relied upon by the Fort to address the impacts of its groundwater pumping not only overestimated the conservation benefit to protected species, but, more fundamentally, was not reasonably certain to occur at all. The Fort, once again, is back at the drawing board looking for a path to continue its operations while attaining compliance with the ESA's requirements.

LITIGATION CONCERNING THE ADEQUATE WATER SUPPLY DETERMINATION FOR THE TRIBUTE DEVELOPMENT

In 2013, the Arizona Department of Water Resources (ADWR) approved Pueblo del Sol Water Company's (PDS) application for an adequate water supply determination to serve the Tribute development, a proposed mixed-use development of 7,000 residential and commercial lots located in Sierra Vista. ADWR's determination would allow PDS to more than triple its annual volume of groundwater pumping to 4,870 acre-feet per year. The Center, along with the Bureau of Land Management (BLM) and one private party, objected to ADWR's determination because the additional groundwater pumping would impact streamflow in the River which was federally protected under SPRNCA's federal reserved water right.

Quantification & Regulation

The case wound its way through various administrative and judicial venues until it was ultimately decided by the Arizona Supreme Court in 2018. In its decision, the Supreme Court ruled that ADWR did not have to take into account SPRNCA's reserved rights as they were not yet quantified nor did the regulations used by ADWR require that other water users' rights, including SPRNCA, be taken into account. The Court further noted that ADWR's regulations simply require that 100 years of water be physically available, which the Center and BLM agreed was accurate, and that because PDS operated a legally approved Certificate of Convenience and Necessity granted by the Arizona Corporation Commission, it had the legal authority to pump such water, regardless of the rights granted by Congress to SPRNCA.

Legal Authority

While PDS received its authority to pump groundwater to serve Tribute under ADWR's regulations, its ultimate legal authority to pump such water will be determined by the Court overseeing Arizona's General Stream Water Rights Adjudication (Adjudication). The outcome of the Adjudication proceedings, briefly described below, will determine how PDS' water rights can be exercised relative to the water rights of others in the region, including SPRNCA's existing federal reserved water rights.

ARIZONA'S GENERAL STREAM WATER RIGHTS ADJUDICATION

The upper San Pedro River watershed is part of the Gila River basin which, since 1974, has been undergoing a basin-wide general stream water rights adjudication to define and quantify the water rights for all water users in the basin. The Adjudication is conducted before Maricopa County Superior Court. ADWR provides technical assistance to the Superior Court and undertakes evaluation of all claims and water uses in the basin. They also assess the hydrologic characteristics, including the interaction of groundwater and surface water through modeling of water along, and adjacent to, water courses. Of significance is that the water uses in the San Pedro River watershed are the first to be evaluated by ADWR and the Court. In 2023 the Court issued a decision on the water rights for SPRNCA, granting SPRNCA rights to a certain quantity of stream flow in the River, and the right to certain water levels in wells adjacent to the River.

SPRNCA Rights

Legal Classification

ADWR's technical work and decisions by the Court concerning the interaction and connection between groundwater and surface water is by far the most critical part of the Adjudication, as those decisions will determine whether water withdrawn from a well will be administered as surface water under the prior appropriation doctrine or groundwater under the laws administering the use of groundwater. It is highly likely, given the region's hydrology and legal decisions that have been made to date, that many of the 8,000 wells in the San Pedro River watershed will be administered in whole, or in part, under surface water laws, and not entirely under groundwater laws.

PETITION TO FORM AN ACTIVE MANAGEMENT AREA

AMA

More recently, the Center has spearheaded a group of concerned entities known as the San Pedro Alliance which have petitioned ADWR to create a groundwater **a**ctive **m**anagement **a**rea (AMA) in the upper watershed. This is the second attempt by the Center to designate the region as an AMA. The designation would create new regulations on the use of groundwater and development of wells. The

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Center believes creating an AMA would limit the future development of wells in the region and require all water users to implement more stringent water conservation measures to reduce the consumption of groundwater in the region. ADWR has yet to make a determination of whether the upper San Pedro watershed warrants designation as an AMA at this time.

Water Management Activities Outside the Courtroom

Collaboration

While all of this litigation has been occurring, interested stakeholders in the region have recognized that the water issues plaguing the upper San Pedro River watershed—particularly the issues raised by the Center involving the Fort and SPRNCA—needed to be addressed outside the courtroom. In 1998 a consortium of federal, state, local, and private entities formed the Upper San Pedro Partnership (Partnership). The stated mission of the Partnership is to undertake activities to preserve the water supply for the Sierra Vista Subwatershed (the southern portion of the upper San Pedro watershed) with a specific emphasis on ensuring the sustainable yield of the regional aquifer to preserve and maintain the long-term viability of the federal reservations in the Subwatershed—SPRNCA and the Fort.

Sustainable Yield

In this context, the Partnership defined sustainable yield to not only take into account the supplies and demands of water for human uses, but also the water supplies and demands of the riparian area, including streamflow and water levels within SPRNCA. In this instance, sustainable yield of an aquifer is much more comprehensive compared to other management goals such as "safe-yield" or "managed depletion" (for more information *see* https://www.azwater.gov/ama/active-management-area-overview).

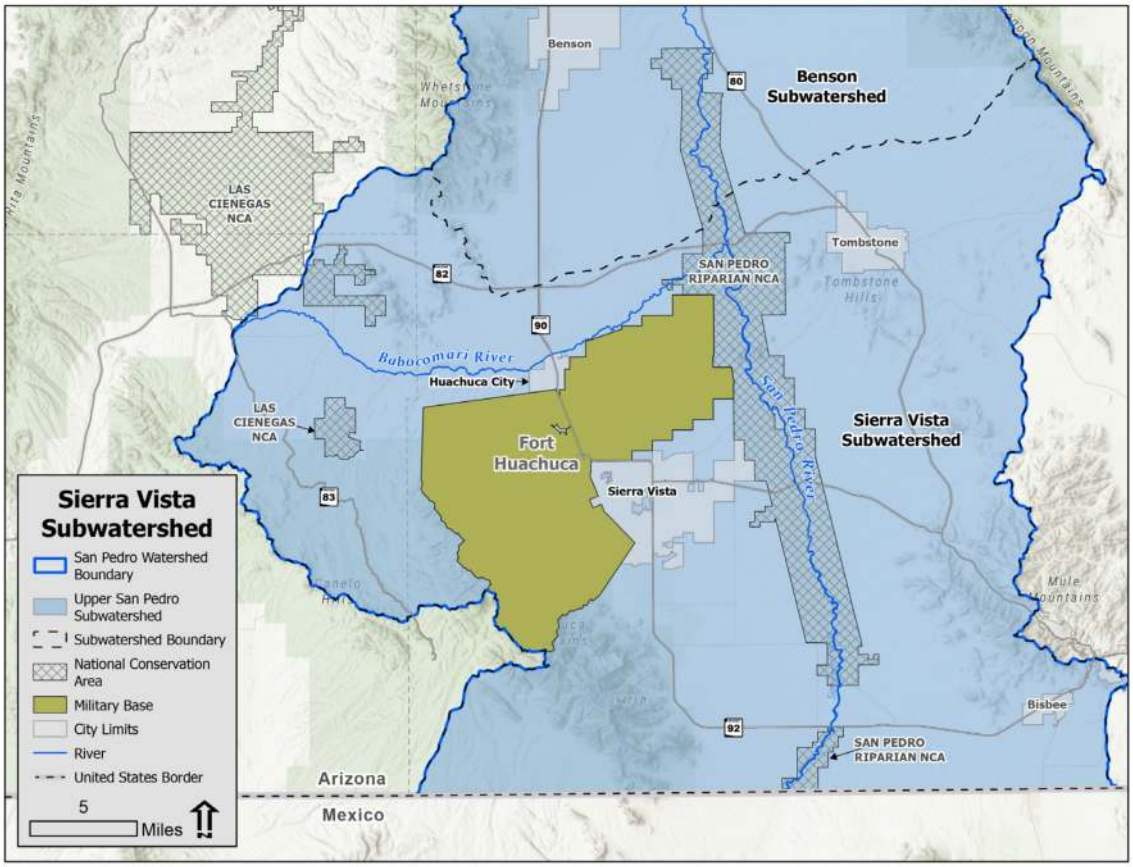

Figure 2. Serra Vista Subwatershed

Progress Reports

The Partnership has been a tremendous success in bringing together local entities to undertake technical work to better understand the interaction of groundwater pumping—for regional water users—and surface water and shallow groundwater needed to preserve streamflow and riparian areas within SPRNCA. In 2004, Congress authorized the Secretaries of Agriculture, Defense, and the Interior to work with the Partnership to identify and implement water management and conservation measures that would enhance and maintain the sustainable yield of the Subwatershed's regional aquifer. The legislation required the entities to report to Congress each year, through 2011, on the progress of their work with a specific emphasis on 1) the annual change in aquifer overdraft, 2) whether the overdraft was lower than the year before, 3) the measures implemented by each Partnership entity, and 4) the extent of contribution

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Overdraft

Augmentation Alternatives

No Action

Feasibility Study

Objectives

of the measures toward reduction of the overdraft. At that time (2004) groundwater overdraft in the region exceeded 9,000 acre-feet per year or nearly 70% of the total human water use in the region.

Because of the significant overdraft, in 2005, the Partnership entered into an agreement with the Bureau of Reclamation (Reclamation) to perform an appraisal-level study of water augmentation alternatives for the Subwatershed. The Partnership and Reclamation agreed that the focus of the appraisal-level study would be to evaluate water augmentation solutions to add approximately 10,000 acre-feet per year by 2011 and 26,000 acre-feet per year by 2050. The 2050 target volume was expected to offset a portion of the 2050 projected total water demand of 38,500 acre-feet per year.

Fifteen alternatives were developed under the following categories:

1) Local alternatives—projects within the Subwatershed
2) Intra-basin alternatives—projects outside the Subwatershed but within the overall Watershed
3) Inter-basin alternatives—projects outside the Watershed

Reclamation and the Partnership screened the alternatives by evaluating their effectiveness, ability to be implemented, and cost. An advisory committee of the Partnership recommended that several options be studied further: two short-term alternatives 1) recharge urban runoff and 2) reclaim the Copper Queen mine water for recharge; and two long-term alternatives both of which would extend the Central Arizona Project (CAP) canal to the Sierra Vista area either for 1) direct use or 2) for recharge.

The study's no action alternative indicated that by 2050 overdraft in the aquifer would be 38,500 acre-feet per year; there would likely be substantial loss of streamflow and riparian areas in SPRNCA; estimated economic losses in Cochise County of one billion dollars per year due to impacts on the Fort's mission; and another one billion dollars loss in economic activity for the State of Arizona due to losses in ecotourism.

In response to the study, which was completed in 2007, Cochise County and the Partnership spearheaded plans to implement the local alternatives to capture and recharge local stormwater and to expand the effluent recharge program that was implemented in 2002. While the Partnership entities developed and implemented these measures, which reduced the annual overdraft, the Partnership's final report indicated that the overdraft had continued throughout the reporting period and, as of 2010, was still approximately 4,600 acre-feet per year.

It became clear to the Partnership as it continued its work that additional measures were needed to address the continuing decline in aquifer storage and the expanding regional cone of depression. Accordingly, at the Partnership's urging, in 2009, Congress authorized and funded Reclamation to conduct a feasibility study of water augmentation alternatives. The feasibility study was to build upon Reclamation's 2007 appraisal study. Work began on the study shortly after it was authorized and an interim report was prepared in 2011. That report highlighted feasibility study work that had been completed by 2011 including development of a comprehensive water management framework, a GIS data dictionary, a bibliography of water resource reports, a well inventory report, and an analysis of human water demands out to 2057. The latter analysis showed that by 2057 the human water demand would result in increased aquifer overdraft of 8,500 to 13,900 acre-feet per year. The actual feasibility study of augmentation alternatives was never completed by Reclamation.

Current Activities of the Partnership and its Primary Partners

Currently, the Partnership continues to oversee and fund technical work in the Subwatershed to monitor groundwater pumping, surface water flows, aquifer health, and water conservation efforts. While all of these programs have been successful in improving understanding of the science of the Subwatershed's hydrology, aquifer overdraft continues and so does ESA and water rights litigation. More recently, in 2021, the primary partners—Cochise County, Sierra Vista, the BLM, and the Fort—entered into a Memorandum of Understanding (MOU) to "ensure the mutually shared goals of an ecologically viable SPRNCA, an operationally secure Fort, and the economic prosperity of the Sierra Vista and Cochise County." The MOU further includes the following common goals and shared interests set forth as MOU Objectives:

- An adequate long-term water supply is available to meet the reasonable needs of the area's residents and property owners (current and future) and fulfill the purpose of the SPRNCA, while managing the impacts of past groundwater use.
- The San Pedro River within SPRNCA is healthy, and the Resource Management Plan Objectives are advanced, thereby furthering the primary purposes for which SPRNCA was established.
- Communities in areas around SPRNCA within Cochise County, Arizona are strong, healthy, diverse, vibrant, and safe, and have opportunities for continued economic growth and development, which fosters local community capacity to support regional water-related objectives.

- Fort Huachuca is able to accomplish its national defense missions, have a safe and adequate water supply and comply with all obligations under the Endangered Species Act.
- Local, state, and federal agencies and partner organizations work collaboratively to reduce environmental, economic, and water supply risks and avoid conflicts related to local water use and federally reserved rights.

(For more information *see* http://uppersanpedropartnership.org/wp-content/uploads/2022/04/SPRNCA_Cooperative_Monitoring_Management_MOU_CochiseCounty_AZ.pdf)

Goals & Actions

These objectives appear to envision that the water and water-related issues that exist today—aquifer overdraft, streamflow depletion, ESA litigation, water rights adjudication decisions—be resolved and that water not be a limiting factor for the region's future. While the MOU Objectives focus on resolving the Subwatershed's groundwater and surface water sustainability issues and allow for economic growth and development, the actual activities the parties plan to pursue (Appendix A to the MOU), unfortunately, are really no different than what has been occurring over the past three decades—recharging the limited supply of water available in the Subwatershed and monitoring the region's hydrology. Interestingly, despite the continuing litigation from the Center and Reclamation's past work on augmentation, the MOU says nothing about completing the feasibility study of augmentation alternatives.

Challenges

As has been clearly shown over the past 25 years, the water resources that currently exist in the Subwatershed are simply not sufficient to meet the MOU Objectives. The water issues that exist today are the same as they were three decades ago. And it appears these issues will become more challenging. The Fort and Service are working on their 5th BiOp and, unless the Fort agrees to forego pumping groundwater entirely (its only source of water and to which it has a federal reserved right to use), the Center will once again sue the Fort and Service over the inadequacy of its ESA compliance. Additionally, the Center continues its quest to limit the use of groundwater through its request for the area to become an AMA. The AMA's assured water supply provisions would likely prohibit the use of groundwater for any future municipal growth in the Subwatershed.

Recently, the owners of the planned Tribute development, which has an adequate water supply determination from the state, have decided to withdraw from its plans to develop the property. It is not known why the owners withdrew, but it's likely that the region's water issues played a part in the owner's decision. Unless a new owner is found to develop the property, this will clearly impact the growth potential of the region.

A New Paradigm for the Subwatershed
A Framework for a Long-Term Solution

It is abundantly clear that in order to sustain the River, meet the objectives of SPRNCA, ensure the Fort's critically important defense mission is met, and maintain and enhance the overall economic prosperity, quality of life, and general welfare of the region's citizens, a new paradigm is needed to address the water issues in the Subwatershed. This new paradigm would be a new approach to implementing an idea that has been studied and was recommended years ago.

Federal Action

The new approach would be spearheaded by action from the federal government to bring assets to the region—just as it has done on the Colorado River system—to address the water supply conflict that exists between the Fort and SPRNCA. This conflict, which is exacerbated by the ESA listed species that occupy SPRNCA's riparian area, has been the source of the litigation in the region for the past three decades. The litigation and concern over water has also impacted the overall economy and growth potential of the region. The water issues, litigation, and economic impacts will only get worse over time unless the Fort and SPRNCA conflict is resolved. As a result, the federal government, which oversees both reservations, bears a significant part of the responsibility of solving the conflict.

Impacts

Both federal reservations require a sustainable water supply in order for each to meet their federally authorized mission. Unfortunately, the source of the Fort's supply (groundwater) is hydrologically connected, and when pumped, impacts the source of SPRNCA's supply (surface water). While the Fort has attempted to mitigate its impact with locally available measures, none of them have proven, so far, to cure the ESA issues. Moreover, while under federal law, the Fort is currently not responsible for the impacts of pumping off the military base, the fact of the matter is that the impacts of pumping off the base to support Sierra Vista and the surrounding communities are largely as a result of the Fort's existence. Consequently, even if the Fort was to cure its ESA issues, the litigation over impacts on the listed species will likely continue unless the pumping impacts off the Fort are also addressed.

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Importation

Given the limited supply of water in the region, it is clear that the only mechanism to mitigate the impacts of pumping on the River's streamflow is to augment the Subwatershed's water supplies by importing water into the region from outside the watershed. The Partnership and Reclamation recognized this early on in their prior work. Unfortunately, to date, nothing has come about to implement an importation program.

Settlement

A tried and true, and highly successful approach to ensure the importation of water to the Subwatershed meets the needs of the two reservations in the long-term, and ideally, forever, is to craft the importation program within a settlement of the water rights litigation. Such an approach would be similar to, if not exactly like, what the federal government and other stakeholders have accomplished in supporting the quantification and resolution of water rights claims of Tribes in Arizona and throughout the West. These comprehensive, legally enforceable, congressionally authorized, and court-approved settlements have provided certainty among the parties and have spurred investment in economic development for the Tribes and the neighboring communities. The same could happen in the Sierra Vista Subwatershed.

Proposal

As with Tribal settlements, a comprehensive water rights settlement in the Subwatershed would 1) establish a water budget for the region's major water users, including the Fort and SPRNCA, linked largely to the imported water supply; 2) fold in existing non-municipal uses; and 3) allow for limited smaller uses to be established in the future. An importation of 14,000 acre-feet of water per year, together with a limit of 6,000 acre-feet of groundwater pumping would—with the inclusion of effluent produced from municipal use (10,000 acre-feet per year)—produce a water budget for the region's major water users of 30,000 acre-feet per year.

New Supplies

Under this scenario, the Fort would agree to not pump groundwater, instead using the imported supply as its water source (up to 4,000 acre-feet per year). As a result, the Center would have no basis on which to object to the Fort's compliance with the ESA. SPRNCA would also be guaranteed a source of water to help sustain the River and its riparian areas (10,000 acre-feet per year). The municipal water providers in the region would agree to collectively limit their pumping of groundwater to 6,000 acre-feet per year by using a portion of the imported water supply (10,000 acre-feet per year) in its place and agree that all effluent produced by their customers would be recharged adjacent to and hydrologically upstream, but connected to, the River. A summary of the proposed annual water budget is shown in Figure 3.

	Water Supply (af)	Water Use (af)	Comments
Imported Water	**14,000**		**10,000 af would be available for municipal and industrial (M&I) uses; 4,000 af would be reserved for the Fort**
Underground Water	**6,000**		**All for non-federal M&I uses**
Effluent from M&I Use	**10,000**		**8,000 af would come from non-federal M&I use and 2,000 af from the Fort**
Total	**30,000**		
Fort Huachuca		**4,000**	**Imported Water (4,000 af)**
SPRNCA		**10,000**	**Effluent from the Fort (2,000 af) and non-federal M&I uses (8,000 af)**
Sierra Vista Area M&I		**16,000**	**Imported Water (10,000 af) and Groundwater (6,000 af)**
Total		**30,000**	

Figure 3. Proposed Annual Water Budget with Augmentation

Responsibility

The federal government would be responsible for funding the planning, design, and construction of a pipeline to import the water supply from the terminus of the CAP canal to the Subwatershed. The federal government would also be responsible for acquiring a portion of the imported water supply (10,000 acre-feet per year), while Arizona's Water Infrastructure Finance Authority (WIFA) would support the acquisition of a smaller portion (4,000 acre-feet per year) of the imported supply to help support future population growth in the region. The costs to operate the new pipeline would be borne by the Fort, SPRNCA (BLM), the County, and municipal water providers, with assistance from the state through WIFA.

The congressional act approving the federal government's inclusion in the agreement would provide the appropriate federal sovereign immunity waivers and include the funding for the infrastructure necessary to transport and use the imported water. The agreement among the federal government, the state, the County, and the municipal water providers would be approved by the Adjudication court and the

court would retain jurisdiction to enforce the terms of the agreement. Again, this approach would resolve the ESA litigation once and for all. It would also resolve the water rights litigation in the Subwatershed as the Adjudication court would approve the settlement and the water rights identified and quantified in the agreement. Those water rights would then be folded into the decree that the Adjudication court eventually enters in the future. The agreement would also provide a pathway for future sustainable growth in the region. The certainty of the water supply established in the water budget for the municipal water providers would allow for planning the region's future economic development without the threat of litigation or regulation by the state. Lastly, individual homeowners living outside the city limits would have a pathway to use a small amount of groundwater for their homes.

Conclusion

The upper San Pedro River watershed is a unique area in Arizona. With its wide-open spaces and spectacular views of the surrounding mountains, it is home to a beautiful, but threatened, riparian area (SPRNCA), an important military base (Fort Huachuca), a city known as the "Hummingbird Capital of the United States" (Sierra Vista), and cowboys and ranchers who make use of the outlying range land. Unfortunately, the region has also been the subject of significant controversy and litigation over water for the past three decades. While the Upper San Pedro Partnership has undertaken a multitude of activities in an attempt to achieve sustainability of the subwatershed's water resources, the water supply available is simply not sufficient. Unless the regional water stakeholders can agree on how to achieve sustainability, the water resource challenges will only get worse.

A water augmentation program crafted within the framework of a Subwatershed-wide water rights settlement agreement would provide a way to achieve sustainability, thus eliminating the litigation that has plagued the region for decades. Now is the time to begin developing this plan while the Fort's 5th BiOp is being prepared. A BiOp that shows that no groundwater pumping will occur on the Fort will result in a successful plan for the Fort's future and thwart any litigation from the Center. Moreover, the state, through WIFA is prepared to now help rural Arizona with its water challenges. Now is the time to capitalize on these opportunities and provide the region with a sustainable water supply future to foster improved economic and quality of life benefits for the citizens of the Sierra Vista Subwatershed.

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The Water Tower

ELEVATING COLLABORATIVE INNOVATION

THE WATER TOWER GLOBAL INNOVATION HUB

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Janet Rummel, HL Strategy (Dallas, TX)

Introduction

The Water Tower (TWT) is a first-of-its-kind global water innovation hub for water and wastewater utilities, researchers, private companies, and water-related organizations to collaboratively solve critical, real-world water and environmental challenges. Located in Gwinnett County, Georgia, TWT provides innovative solutions for utilities in the water sector while attracting and training the next generation of water professionals.

Background

Addressing Challenges

Water resources are foundational to the vitality of communities across the globe. Yet, water planners and providers face a wide array of complex challenges as they provide safe, reliable water services 24 hours a day, 7 days a week. Gwinnett County—located in the metro Atlanta area—has a long-standing reputation for being proactive and innovative, especially when it comes to water. The F. Wayne Hill Water Resources Facility, constructed in the early 2000s in Buford, is still considered one of the most advanced water reclamation facilities on the Eastern Seaboard.

To help utilities and communities tackle water challenges beyond the Gwinnett County borders, County leadership launched The Water Tower initiative in 2019, creating two nonprofit organizations with separate missions to achieve collective goals.

Non-Profits

The Water Tower at Gwinnett, a 501(c)(4), is responsible for the development and operations of the campus, and The Water Tower Institute, a 501(c)(3), is responsible for solutions, instruction, and engagement programming. Together, these entities are committed to creating a thriving ecosystem of water innovation fueled by imagination, informed by research, and powered by pioneers. This is being accomplished by bringing together the public and private sectors of the water industry, side by side with academia and nonprofits, to tackle the industry's greatest challenges.

The Water Tower Innovation Hub

Multi-Use Space

The Water Tower's facilities include an innovation center with multiple classrooms, a large conference space, analytical, microbiology, and experimental laboratories, a podcast studio, co-working space for short-term water startups, long-term office space for water-related businesses, a living laboratory technology demonstration area, a hydraulic training lab, and a field training center. All of the spaces were designed to support TWT's core programming in applied research, technology innovation, workforce development, and industry engagement.

Demo Day

On Earth Day (April 22, 2022), water professionals from across the country gathered to celebrate the grand opening of TWT's state-of-the-art campus. The day-long celebration also served as its first annual Demo Day, featuring more than 350 attendees and 40 exhibitors. Each year, the Demo Day invites representatives from water technology companies and manufacturers, consulting and engineering firms, and water utilities to spend a day experiencing the industry's latest technologies in the field and in the control room while networking with public, private, and nonprofit peers. Participants can tour the world-class facilities featuring multiple laboratories, a field training center, and water treatment demonstration areas as they view live presentations and learn about innovative solutions to help modernize water utility processes and operations. The next Demo Day will be held on April 18, 2024, and sponsorship, exhibitor, and attendee registration is now open (*see* www.theh2otower.org/demo-day).

TWT also hosts events throughout the year and invites water utilities, researchers, and companies with groundbreaking advancements to use the campus year-round as a hub for collaborating to solve critical water and environmental issues. The campus provides opportunities for TWT partners to use short-term and long-term rental space for hosting events as well as traditional classroom and in-the-field training. Partners also have access **r**esearch and **d**evelopment (R&D) resources including live water quality flows from the neighboring F. Wayne Hill Water Resources Center, three research laboratories, and state-of-the-art equipment.

The Water Tower welcomes organizations to host water industry conferences and trade shows on its campus. In 2023, organizations held events to collaborate on issues related to: cybersecurity, water quality, treatment processes, reuse, hydraulics, backflow prevention, stormwater, workforce training and

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safety, women and diversity in leadership, and economic development. TWT was proud to be the venue for the 2023 Empowering Pumps & Industry Conference, WateReuse Association Conference Workshop, and National Backflow Prevention Day Celebration.

Access to Assets

One of the unique aspects of The Water Tower's living laboratory and Demonstration Facility is its location adjacent to the F. Wayne Hill Water Resources Center, which provides access to live wastewater streams from the treatment plant, including primary influent, secondary effluent, advanced treated wastewater, and potable water. TWT works with technology companies and provides access to additional assets found in Gwinnett County including 3,800 miles of distribution system, 3,000 miles of collection system, 220 pump stations, and 1,500 miles of stormwater system for research and testing in real-world conditions. In addition to Gwinnett County's assets, TWT works with utilities throughout the southeast to host demonstrations at their facilities, which provides utilities with valuable information and the opportunity to test potential solutions prior to making key decisions. With a focus on digital technologies—which have enormous potential to improve the efficiency of water utilities—TWT is able to visually display results from technologies being demonstrated.

Certification

Additionally, The Water Tower's technology validation program provides independent, expert reviews of technologies against their advertised metrics. For each technology a panel of experts evaluates testing protocols and outcomes. The result is an independent validation certification from TWT that offers credibility in the water industry.

Digital Technologies, Innovation, and Controls

Big Data

The water sector has a historical predisposition to risk aversion, founded in the reality that there are definite public health challenges associated with this work. The result is that the industry has unfortunately lagged the advances in technology, data, and analytics that have revolutionized a host of other industries including commerce, airlines, financial institutions, and political campaigns. Limited capacity in data acquisition and the tools necessary to curate and analyze that data have hindered the use of "big data" in water.

Impediments

Other impediments for technology innovation in the water sector include:

- Technologies in search of a problem, as opposed to technology developed to solve existing challenges facing the industry
- Adaptation of the technology to the water utility landscape
- Technology that is not able to address the entire problem
- Lack of open interfaces and middleware for integrating systems
- Water sector's lack of access to Digital Twin Systems—digital replicas of utility assets, such as water resource recovery facility control systems, that update in real time and can be used for training as well as technology testing and demonstrations

Data Infrastructure

With the availability of **a**dvanced **m**etering **i**nfrastructure (AMI), rapidly decreasing cost of sensors, and the availability of massive data sets—including weather and climate, hydrological, and remote sensing information—water utilities now have a significant opportunity to expand their data footprint.

However, in order to realize this, utilities require a data infrastructure that:

- Provides a place for that data to land
- Provides a curation mechanism for that data
- Provides the means to analyze that data

Solutions

TWT's vision is to bring together key stakeholders to address these challenges by taking the lead in demonstrating the impact of digital transformation and the integration of data platforms and systems. This will be done through the following avenues:

- Providing a Data Exchange Gateway or Application Programming Interface (API) marketplace
- Bridging technology silos and beginning the path toward data standards
- Exploring the capabilities of AI, Digital Twin, Neural Networks, and Machine Learning to ingest and analyze unstructured data
- Opening access to data for third-party developers

The Control Room at TWT includes the tools necessary to visualize digital technologies: a GIS-based system, a Supervisory Control and Data Acquisition (SCADA) system, and the ability to create a Digital Twin of multiple facilities. When you combine these features with The Water Tower's workforce development and training components, the opportunity for advancement vastly increases.

The Water Tower

Innovation Programs

Collaboration

Workforce Succession

Licensing

Pilot Program

International Collaboration

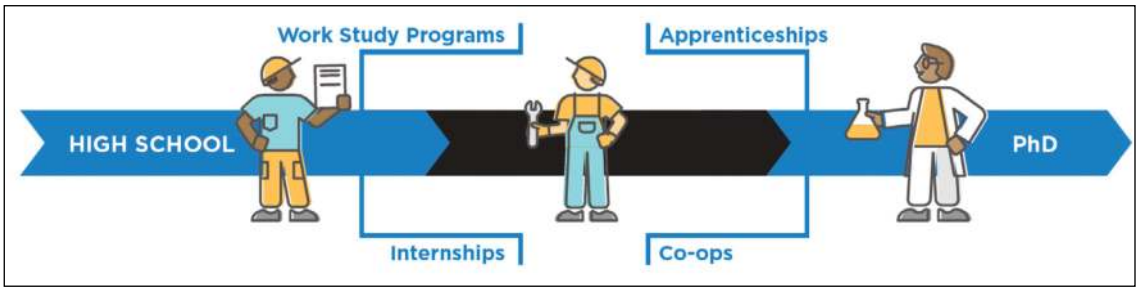
TWT, in partnership with global consulting firm Arcadis, hosted a group of international water and wastewater utilities in October 2022 for the first of a series of four workshops to advance innovation initiatives in the water sector. More than 35 participating utilities and partners are contributing over $465,000 in monetary and in-kind support to complete a global research project aimed at presenting utilities with a roadmap of best practices and metrics for successful innovation programs. A previous study led by the project team revealed that while utilities are seeing positive impacts from innovation programs, many struggle to clearly measure and communicate their value. TWT and its fellow research partners hope to change that.

This project, titled "Leveraging Utility Innovation Performance Measures for Program Management and Organizational Transformation (TWTI-21-01)" is TWT's flagship collaborative research project. The Arcadis-led project team includes water utility partners from the US, Canada, Australia, and Brazil as well as Rogue Water and Means Consulting. The team is conducting surveys and workshops on best practices for innovation programs within and outside of the water sector. The project has support from a technical advisory panel of representatives from the American Water Works Association, Water Environment Federation, Association of Metropolitan Water Agencies, Water Research Foundation, and Water Services Association of Australia.

The findings of the workshops and survey will feed into resources that utilities can use when crafting a narrative to their leadership and staff regarding the importance of establishing a program for innovation and idea generation to ultimately deliver a high quality of life for their customers. The final deliverables resulting from this global study will be released by The Water Tower in early 2024.

Training the Next Generation of Water Professionals

Water utilities are projected to lose 30 to 50 percent of their workforce to retirement over the next decade. TWT is helping utilities with their personnel and technology challenges through workforce initiatives including recruitment, training, placement, and upskilling, as well as access to demonstrations and free testing of innovative technical solutions. TWT offers specialized, hands-on training programs for workers with varying education and experience—from entry-level to mid-career. The institute also offers internships, apprenticeships, co-ops, and work study programs for high school graduates and those looking for a career pivot into the industry.



In May 2022, using funds provided through the American Rescue Plan Act, TWT launched the Water Workforce for Resilient Communities Program, coordinated by Gwinnett County. The program targets underserved populations and other service industry workers who lost jobs during the pandemic and offers two tracks—an 8-month work-study program for high school seniors, and a concentrated 4-month program for individuals with a high school diploma or GED, both culminating with the state certification exam. Once they are licensed, TWT will help place qualified candidates at water and wastewater utilities in north Georgia. The Water Tower is partnering with local nonprofits Georgia Center for Opportunity and Corners Outreach to recruit program candidates. Additionally, a paid social media campaign has been successful in generating leads for TWT staff to contact potential participants and place them into the program.

The program's first graduate passed her certification exam in November and is working with TWT to secure her first job in the industry. This program will serve as a pilot to be scaled to include multiple training center locations in regions across the United States, led by TWT.

The Water Tower

Student Summit

Projects

Student Leadership Summit

In addition to R&D and technology innovation, another area of focus is STEAM education and outreach with the goal of encouraging students of all ages to explore learning opportunities and careers in science, technology, engineering, arts, and math. TWT has hosted two Water Innovation and Leadership Summits to bring together Georgia high school students to learn about careers in the water sector. The Student Summit is part of The Water Tower's broader mission to attract, train, and place the next generation of water workers in positions to support Georgia water utilities. Currently, there are an estimated 1,200 open water jobs in the Atlanta Metro Area alone.

Over 150 north Georgia high school students attended each summit at the TWT campus to learn how they can "Make a Splash" with a career in the water industry. Students (grades 9-12) engaged with the summit speakers from water-related businesses and organizations and experienced hands-on learning. Attendees had the opportunity to discover different roles, processes, technologies, and innovations involved with water industry careers. They engaged with industry professionals during a career fair to strengthen their skills in leadership, communication, strategic thinking, team building, and networking.

They also participated in hands-on activity stations covering topics including in plant operations, microscopy, lab skills, GIS, smart technology, pipeline design, engineering, filtration, stream restoration, underwater robotics, wildlife assessment, scientific artwork, crisis communication, robots in water pipeline systems, and more.

Applied Research and Development

TWT participates in several types of research efforts to ultimately serve water and wastewater utilities by helping to ensure access to safe, affordable, and resilient water services. Research efforts include:

The Water Tower-managed projects: These projects, such as the "Leveraging Utility Innovation Performance Measures for Program Management and Organizational Transformation (TWTI-21-01)" project, are developed with input from technical experts, approved by the TWT Research Advisory Committee (RAC), managed by The Water Tower, and overseen by a volunteer Project Advisory Committee (PAC) of experts.

Partner Research projects: These efforts are proposed to TWT or external funding agencies by partners including utilities, universities, industry, and other organizations. The projects are often collaboratively funded and managed by TWT. The proposing partner benefits from technical oversight of the project by a PAC of experts and publication and dissemination of the project outputs to TWT's network.

The Water Tower

Academic Partners

Research

Technology R&D projects: Companies interested in conducting R&D on campus can utilize TWT's state-of-the-art laboratories, demo area, and staff support.

For purposes of research, The Water Tower offers laboratory analytics support for utilities and universities, as well as opportunities for visiting professors and students to conduct water-related research in its three labs. Current academic research partners include Georgia Tech, Georgia Gwinnett College, University of North Georgia, University of Georgia, University of Alabama, University of Texas at Austin, and other esteemed institutions.

Multiple collaborative research projects were launched in 2023 addressing key challenges in the industry.

Notably, TWT is participating on two research teams recently awarded more than $2 million in EPA research grants on disinfectants, **d**isinfectant **b**y-**p**roducts (DBPs), and **o**pportunistic **p**athogens (OPs) in **d**rinking **w**ater **d**istribution **s**ystems (DWDS).

1. "Integrated Water Microbiome and Disinfection Byproducts Monitoring and Management to Advance Drinking Water Quality," led by Dr. Ameet Pinto at Georgia Tech, seeks to develop an integrated framework to quantitatively monitor the drinking water microbiome, including waterborne pathogens and DBPs, and holistically manage waterborne pathogens and DBP risks in drinking water storage and distribution systems using inclusive and actionable risk metrics.
2. "Consortium on Disinfection By-products and Opportunistic Pathogens in Water Networks (CO-DOWN)," led by Dr. Mary Jo Kirisits at University of Texas, Austin, aims to achieve a nationwide study of the prevalence of OPs, their free-living amoebae vectors, and (un)regulated DBPs across a wide variety of sizes and types of DWDS Researchers will also examine fundamental scientific hypotheses related to the occurrence of OPs and DBPs in DWDS and their relative risks.

(To learn more about these projects, *see* https://www.epa.gov/research-grants/national-priorities-research-disinfectants-disinfection-products-and-opportunistic)

Leadership Succession Planning Involving Diverse Perspectives

Increasing Diversity

Since its inception, the water industry, like many sectors, has been typically male-dominated. However, efforts to involve women and minorities in key water industry jobs have made headway in recent years. There are still many gaps and challenges that need to be addressed, especially when it comes to leadership in the water industry. It is clear that we need more diverse voices not just in the water sector but also serving in senior roles such as general managers and deputy general managers within utilities, senior roles within consulting, and CEOs of nonprofits.

ReSoLve

Recognizing this need, the Responsible Succession Leadership (ReSoLve) program, a first of its kind initiative, was hosted by The Water Tower in 2022 with a focus on discussing challenges and creating action plans to develop a pipeline of female leaders for senior roles in water. The first cohort workshop, held at The Water Tower in February 2023, brought together a diverse group of 30 senior female water leaders and six young women water professionals to discuss topics related to succession planning, including bias, mentoring and allyship, safe spaces, work-life integration, self-care, and more. A second cohort met at The Water Tower in December 2023. Both workshops were a great success, with robust conversations and many crucial takeaways and action items identified. Additional cohorts will be established to continue important discussions around challenges facing women and minorities in the water industry.

Conclusion

Since the inception of the nonprofit organizations that comprise The Water Tower in 2019, TWT has been laser-focused on making a positive impact in the water industry through collaborative innovation. In its first year of being open, The Water Tower campus attracted over 8,000 visitors to see its unique, state-of-the-art facilities and fully functioning, real-world test conditions. By providing a forum for water professionals from all sectors, industries, and organizations to come together to solve the latest water challenges, The Water Tower is reimagining the future of water for the benefit of communities across the Southeast and beyond.

For Additional Information:

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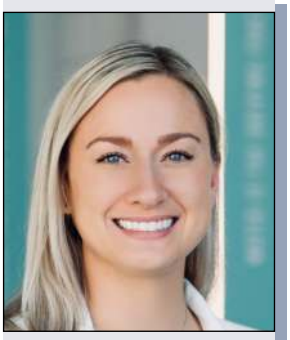
Kristan Vanden Heuvel


Melissa Meeker


Janet Rummel

Kristan Vanden Heuvel is the Director of Impact and Engagement for The Water Tower. She has over 10 years of experience in the water industry in research program planning, working with stakeholders and technical experts, project and grant management, as well as a passion for helping others understand the importance of water for every aspect of life. In her previous role at The Water Research Foundation (previously WE&RF and WRRF), she managed 40+ water reuse and desalination projects for the water community valued at over $15M. In her current role as Director of Impact and Engagement at The Water Tower, Kristan is responsible for directing communications, outreach, and development efforts to foster strategic partnerships and steering programming to engage stakeholders and next-gen water workforce to advance cooperative innovation.

Melissa Meeker is the CEO of The Water Tower and has over 30 years of experience in water resources management with an emphasis on water supply diversity and resiliency through alternative sources including reuse, stormwater, and desalination. Having worked in public, private, and not-for-profit sectors, Melissa's broad range of expertise covers public policy, regulation, and management with a focus on innovative technologies, workforce development, and public engagement. Throughout her career, Melissa has demonstrated a unique grasp of state, federal, and international dynamics, keen political instincts, and a proven track record of working with decision-makers and boards to develop effective programming to address the water industry's most pressing challenges. Melissa currently serves as the Chief Executive Officer of The Water Tower at Gwinnett and The Water Tower Institute, two nonprofits focused on enabling solutions in research, technology, training, and engagement around water.

Janet Rummel is a strategic communications consultant for HL Strategy based in Dallas, Texas. She has over 20 years of experience in public relations, issues management and stakeholder engagement for municipal water and wastewater utilities in multiple states. As a consultant with HL Strategy, Janet supports The Water Tower, Metropolitan North Georgia Water Planning District, Opelika Utilities, and Columbus Water Works with communications and outreach on water innovations, workforce development, conservation, infrastructure, quality, rates, and regulations. Learn more about HL Strategy at www.hlstrategy.com.

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US Infrastructure

PREPARING US CRITICAL INFRASTRUCTURE FOR EVOLVING WATER CRISES

EXCERPTS FROM THE NATIONAL INFRASTRUCTURE ADVISORY COUNCIL REPORT

Editor's note: In 2023, the President's National Infrastructure Advisory Council released a 39-page report: Preparing United States Critical Infrastructure for Today's Evolving Water Crises.

This report provides insights into current infrastructure challenges, and proposes recommendations to address them. What follows is an abridged version of that report, which has been edited and condensed to better match our format. The full report is available here: https://www.cisa.gov/sites/default/files/2023-10/NIAC_Preparing_United_States_Critical_Infrastructure_for_Today%27s_Evolving_Water_Crises_Report.pdf

Introduction

The President's National Infrastructure Advisory Council (NIAC) is composed of senior executives from industry and state and local government who own and operate the critical infrastructure essential to modern life. At the President's request, NIAC members conduct in-depth studies on physical and cyber risks to critical infrastructure and recommend solutions that reduce risks and improve security and resilience.

Preparation

On December 27, 2022, The National Security Council (NSC) tasked the NIAC to answer the following questions: How should the US Federal government help critical infrastructure owners and operators prepare for the rapidly evolving water crisis (including the Colorado River Basin) and what actions should we take now to minimize cross-sector impacts?

To address these questions, meetings and briefings with water agencies, water organizations, water utility owners and operators, research centers, and members of academia were conducted between February and July 2023 (*see* the full report for a complete list of briefings).

National Strategy

As a result of these deliberations, the NIAC identified eight main areas in which the US Federal government can aid owners and operators of critical infrastructure to prepare for the evolving water crisis and six major categories of recommendations associated with them. Four critical sectors strongly connected to water were identified and recommendations to minimize cross-sector impacts of the evolving water crisis were presented. Finally, NIAC proposed the creation of a national water strategy stewarded by a new Department of Water or Cabinet-level entity.

It is acknowledged here, and in the full-length report, that the topics and recommendations are not exhaustive in nature.

Challenges in the Evolving Water Crisis for Critical Infrastructure Owners and Operators

Water Use

Water access is central to every aspect of the US economy. Per the United States Geological Survey (USGS), power generation is the biggest user of our nation's water at 41%; irrigation, at 37%, is the next largest user; public consumption is at 12%; and mining/industrial/technology/manufacturing use comprises another 6%.

Complexity

Delivering water to communities, businesses, and industries in the US is complex. Water is not often located where it is ultimately needed. Canals and other conveyances distribute raw water to where it is treated. Water infrastructure at the local level consists of treatment plants, distribution pipes, pumps, and other drinking water facilities. Large water supply infrastructure such as dams and reservoirs capture precipitation and store water until it is used. Federal, state, tribal, county, and municipal governments as well as private entities and public/private partnerships own and/or operate parts of this critical infrastructure. This complexity extends to the framework within the US Federal government that stewards water at the national level. The NIAC identified the following eight themes in discussions of how to help owners and operators of critical water infrastructure prepare for the rapidly evolving water crisis.

UNSUSTAINABLE USE OF WATER

The nation's current state of water infrastructure and increasing demand for fixed supply of water is unsustainable. Decades of chronic underfunding and underinvestment have impacted the condition, reliability, and resiliency of the nation's critical water infrastructure. The US government's share of capital costs on water infrastructure fell from around 60% in 1977 to below 10% in 2020.

The American Society of Civil Engineers' (ASCE) Report Card for America's Infrastructure 2021 report (https://infrastructurereportcard.org/) analyzed the impact of not investing in drinking water and wastewater infrastructure on the gross domestic product, businesses, households, and public health.

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Investment Gap

The report predates the current Federal investment in water infrastructure—namely the Infrastructure Investment and Jobs Act (IIJA). The ASCE report states that in 2019, the total capital spending on drinking water and wastewater infrastructure at the local, state, and Federal levels was approximately $48 billion, while investment needs totaled $129 billion, creating an $81 billion gap for just that year. The IIJA appropriated to the Environmental Protection Agency (EPA) roughly $50 billion on drinking water and wastewater infrastructure improvements over five years (or $10 billion per year). This investment by the Federal government and the American people clearly helps to close the gap in annual water infrastructure investment but does not cover all of the nation's drinking water and wastewater infrastructure investment needs.

Replacement Era

The great majority of Americans have the benefit of clean, inexpensive water on demand. But most of our water supply infrastructure is at, or near, the end of its design life. Extreme weather events prompt more frequent boil orders due to the failure of stressed aging water infrastructure. The American Water Works Association (AWWA) estimates that most of the nation's existing drinking water pipes must be repaired or replaced before 2040, necessitating a "replacement era" that will dramatically increase costs to utilities and their customers. ASCE's 2021 Report Card for America's Infrastructure gave US dams a "D" grade, and the Association of State Dam Safety Officials (ASDSO) has identified over 15,000 dams that pose a high hazard of failure. The ASDSO also estimated in 2022 that the cost of rehabilitation of non-Federal dams is $75 billion due to decades of deferred maintenance and repair.

Leaks

The true costs of supplying and treating water (i.e., the "value" of water) are often not reflected in the price the consumer pays. Water utilities have resisted increasing the price of water until recently, and instead covered the increasing cost through reductions in operations and maintenance (O&M). Due to deferred maintenance, about one-sixth of finished water in the US never reaches customers but leaks out of storage and distribution systems. This loss of revenue is borne by the utilities because leaked water cannot be billed since it never reached the user.

Storage

The other reason that our nation's current use of water is unsustainable is overreliance on stored surface water and groundwater, particularly in the arid western states. Groundwater can be a sustainable water supply source if the total water entering, exiting, and being stored in the aquifer is conserved at sustainable levels. Similarly, surface water captured from rain and snowmelt and water stored in dammed reservoirs can be used sustainably if the water levels in the reservoirs are maintained at viable levels.

Drought

In the West, population growth and rampant development, decades of drought, overuse of stored surface water, and over-pumping of groundwater have created a critically unsustainable situation. The water levels of the nation's two largest reservoirs, Lakes Mead and Powell, are at record low levels, impacting hydropower production and the ability to operate the associated dams. The Colorado River is a case in point, and its water issues are exacerbated by several factors. The total amount of water that the century old Colorado River Compact uses as a base amount is more than the Colorado River can supply.

The area is in its 23rd year of drought, so the river's flow is down by about 20% when compared to flows in the 1900s. Yet water usage has dramatically increased over the years and has not been significantly scaled back until the 2023 Colorado River agreement. Although these agreements will significantly increase water levels in Lake Powell, they are temporary and do not bring the reservoir's water level up to sustainable levels. If the megadrought continues, a more sustainable solution must be reached. *See* full report for ways to increase water supply sustainability.

ISSUES WITH WATER QUALITY

Contamination

Raw water quality can be impacted at its source (groundwater, rivers, and reservoirs) and treated (finished) water can be contaminated during distribution from the treatment plant en route to the customer. Sources of contamination include fertilizers and pesticides applied to farmland, runoff from concentrated animal feeding operations, outflows from manufacturing operations, sewer overflows, storm water, the dissolving of chemicals found in rock and soil into groundwater, the dissolving of chemicals such as lead in pipes, pipe joints, and other fixtures into finished water during distribution, and seepage of contamination into leaks in distribution pipes if water pressure is lost. Climate change impacts source water quality because more intense rainfall can increase both the concentration of pollutants and sediment beyond those occurring during normal conditions. Sea level rise can also cause salt contamination of coastal aquifers as well as near delta riverine freshwater intakes.

PFAS

Recent water quality issues of concern are lead in distribution piping and per- and polyfluoroalkyl substances (PFAS) in source water. The EPA estimates that there are over 9 million lead service lines that are known to be a significant source of lead contamination. According to AWWA, $60 billion is needed to replace lead pipes; the IIJA investment in lead pipe removal is $15 billion, leaving a gap of $45 billion to be paid by utilities and their customers. New EPA regulations setting limits on PFAS in drinking water

US Infrastructure

have recently been proposed due to the impact of PFAS on public health. The proposed National Primary Drinking Water Regulations (NPDWR) will require public water systems to monitor for PFAS and reduce levels if they exceed the proposed limits. Costs for the monitoring, removal, and disposal of PFAS will exceed the additional EPA funding available, requiring utilities and their ratepayers to cover the rest. Such unfunded or underfunded mandates add additional stress to water providers who also must replace aging infrastructure and assure sustainable water supplies.

WATER INEQUITY AND UNAFFORDABILITY

Water Access

Water supply infrastructure in the US ranges from large municipal systems serving millions of people to private wells serving a single family. The majority of US residents have access to clean, reliable drinking water, but not everyone. An estimated 0.5% to 1% of US residents do not have piped water; these instances often occur in low income and minority communities (e.g., colonia communities in Texas, tribal lands, and Alaskan Native villages). USGS estimates that 15% of the US population relies on individual or shared water systems. These systems are most often in rural areas where water quality testing is limited and are generally subject to few regulations. Most US residents get their water from community water systems. This does not guarantee the water quality or reliability of the system. Just 9% of the community water systems provided water to 80% of the country with the remaining 91% servicing small communities. Small water systems more often service low-income areas.

Costs

Ideally, the price of water covers the cost of providing it. Many factors impact the ability of providers and their ratepayers to develop and maintain needed water supply capabilities. One factor is the age of the water infrastructure. Many jurisdictions do not account for the full lifecycle cost of building, operating, maintaining, upgrading, and replacing systems. Often water utility owners and operators are unable or unwilling to raise rates to pay for needed investment. Rates can be based on the least cost, which relies on patching and repairing and ignores longer-term problems and consequences. This has negative impacts on water quality and reliability. Low-income and vulnerable communities are more likely to lack access to clean reliable water.

Climate change and water scarcity also disproportionately impact marginalized and low-income communities. In regions where drinking water is obtained from aquifers that are being depleted, large utilities are more likely to have the financial resources required to drill deeper water wells, but adjacent rural or low-income communities are challenged to do so.

FRAGMENTATION OF WATER

Jurisdictions

In the US over 150,000 public water systems are owned and/or operated by a variety of entities. Roughly 80% of all water utilities are publicly owned and operated by municipalities. Most of these are small with the great majority of publicly owned water systems serving populations of less than 3,300. Community water systems are not typically connected to adjacent systems, unlike electricity and transportation infrastructure, which are interconnected into national networks. Small publicly owned water systems are less likely to have the resources to deal with short- or long-term water scarcity, to have access to diverse sources of raw water, and often have limited ability to store treated water for resiliency during short-term outages. Each state and jurisdiction also have specific laws regarding access and water rights adjudication that impact water fragmentation.

Regionalization

Water service regionalization occurs when multiple individual water systems consolidate operations, maintenance, and/or financial management. This consolidation can be small scale, such as joint procurement, or complex and large in scope. The objective is to realize operational efficiencies and economies of scale. It can also provide greater financial stability and access to capital. Full scale consolidation requires complex coordination between municipalities, changes in the way water is managed, and often construction of new infrastructure.

CLIMATE CHANGE

Operators of large water systems often have over one hundred years of historic record to aid them in their long-term operation and planning efforts. Research, using tree ring data, has backfilled past temperature and precipitation information predating the historic record. This has allowed water sector decision makers some degree of certainty in the past. Similarly, traditional hydrologic frequency analysis assumes that climate is static, meaning that the statistical properties of hydrologic variables in future time periods will be similar to those in the past time periods, which until recently was an easily defendable assumption.

US Infrastructure

Extreme Events

Weather events over the last two decades indicate that weather has become much more erratic. Examples include last year's atmospheric rivers in California after a record 23-year period of drought and record water levels of the Mississippi River. Hurricanes are becoming increasingly more intense and cause billions of dollars in flood damages. Extreme weather events, exacerbated by increasing temperatures, are contributing to failures of inadequate and poorly maintained water infrastructure, which disproportionately impact economically depressed communities which often include greater percentages of older adults, individuals with disabilities, and people of color. Water losses in the West due to evaporation will increase with rising temperatures. Raw water capture and storage systems must be altered in light of anticipated shifts in precipitation. Projects that capture available precipitation, stormwater, or floodwater for aquifer recharge or for replenishing depleted surface water storage must be located where high flows exist. To meet the water related challenges of climate change, accurate climate predictions and weather forecasting is necessary. To incorporate climate change into tools and to provide more accurate, reliable, and timely precipitation forecasts across timescales, from seasonal to decadal, the National Oceanic and Atmospheric Administration (NOAA) has recently launched the Precipitation Prediction Grand Challenge Strategy (https://www.noaa.gov/explainers/precipitation-prediction-grand-challenge-strategy).

NOAA Strategy

Development & Training

WORKFORCE CHALLENGES

Water utilities face challenges in recruiting, training, and retaining their workers. About one-third of the current water sector workforce will be eligible to retire in the next ten years. New water quality regulations—such as the limits on forever chemicals—and threats such as cybersecurity compromises will require a more specialized workforce. Workforce development will require upskilling and reskilling current employees, enabling re-entry of retirees, and ensuring skill enhancement is equitable. Attracting individuals from disadvantaged communities to a career in water will be key to creating the water utility workforce of the future.

Opportunities

Women are particularly underrepresented in the water sector workforce. Most young people, including women, do not view the water sector as an attractive career path, but, increasingly, young people want to make the world a better place. Employment in the water sector can be made more appealing by promoting that work in this sector can ensure that all Americans have access to safe, sufficient water. Smart system monitoring technologies, advances in treatment processes, and new processes and information system management will provide many opportunities for people entering the workforce to have successful, fulfilling, and exciting careers. The industry must reach out and promote these new exciting career opportunities. Overcoming the reputation of being a stodgy, low-tech, male workforce is one issue, another is that the future water sector workforce requires commensurate compensation with increased skill sets.

BARRIERS TO INNOVATION AND IMPLEMENTATION OF NEW CAPABILITIES

Increasing Data

There are many new, innovative approaches to delivering safe and sustainable water. Innovative digital water management includes the use of **a**rtificial **i**ntelligence (AI), the **i**nternet of **t**hings (IoT) sensors, and advanced meters that enable remote asset management and improve decision making.

The use of novel delivery methods and water treatment technologies can address efficiency, energy usage, and structural delivery. Currently, these advances are mostly used in industrial, agricultural, and energy production where water is a raw material input or where water costs drive users to become more efficient with the water that is available.

Financing Models

New public-private partnership O&M services and financing models are emerging, such as integrated solutions or **d**esign-**b**uild-**o**wn-**o**perate and **m**aintain (DBOOM) services. Industrial users are embracing third-party investors for O&M as well as direct ownership of water assets. The trend is also accelerating for municipal systems. By entering long-term contracts with service providers, water facility operators can reduce costs and improve efficiencies. Industrial operators are also starting to change their mindset from viewing wastewater as a compliance cost to viewing it as a reliable and sustainable water source.

Barriers

These and other advances would significantly contribute to ensuring access to safe and sustainable water resources nationwide; however, there are barriers to the use of novel methods in the water sector, not the least of which is the risk of regulatory noncompliance when trying something new. Other barriers include lack of personnel needed to institute new processes, equipment, and procedures; limited or no funds devoted to investment in new equipment; and hesitancy in adopting new methods because of limited availability. There are issues in scaling from research quantities to production quantities of new materials and equipment. Some new technologies simply must be proven and their efficacy validated through bench and full-scale studies. Barriers to partnerships with private entities to deliver drinking

water include the municipal owner's (i.e., the mayor's) fear of loss of control. The removal of these barriers could enable a golden age of technology in water.

EMERGENCY MANAGEMENT

Rising incidents of water crisis creates the need for holistic emergency management. Water is a lifeline sector that serves communities, industries, and businesses daily and has the power to bring them back to normal after a disaster, which makes quickly restoring water services the highest priority.

Interconnections

As stated previously, community water systems are not typically connected to adjacent systems, unlike electricity and transportation infrastructure, which are interconnected into national networks. The connection of a water system to adjacent systems can allow for transfer of water during emergency situations. With climate change and increasing water scarcity—as well as high intensity precipitation events—the number of significant water crises has dramatically increased. For example, Hurricanes Laura and Delta in 2020, both affecting Southeast Louisiana, impacted water supply for over 300 utilities. Hurricane Fiona in 2022 impacted the power grid in Puerto Rico and the lack of power made the water systems throughout the island inoperable. New Orleans lost power for 31 days in 2021 due to Hurricane Ida that had a cascading impact to the city's water system.

Other natural hazards are exacerbated by water-related issues. The Lahaina wildfire in Maui, Hawaii—the deadliest wildfire in the US in over 100 years—was compounded by inadequate fire protection water pressure. Lahaina's water system, relying on a limited supply from surface water and groundwater, was compromised due to persistent drought conditions combined with population growth.

Recommendations to Aid Infrastructure Owners and Operators

NIAC members proposed a range of recommendations in six major categories where the US Federal government can help owners and operators of critical water infrastructure prepare for the water crisis.

CREATE, INCENTIVIZE, AND ENFORCE STANDARDS FOR WATER USE AND QUALITY

Standards

- Promote, at the state, tribal, and local levels, that new development (agricultural, commercial, housing, and industrial) demonstrates access to a sustainable water supply.
- Streamline the permitting process, which can take eight to ten years for complex projects.
- Incorporate regulatory "teeth" into source water protections as opposed to relying on water treatment at the backend.
- Set reasonable timelines for compliance with new regulations for water quality, particularly those new standards that require adding entirely new processes and equipment.
- Support the National Groundwater Monitoring Network and fund cooperative groundwater quantitative and qualitative data collection.

REMOVE BARRIERS TO NEW WAYS OF FUNDING WATER PROJECTS

Incentives

- Incentivize sustainable investment strategies at the regional and local levels to diversify and have strong interconnectivity with adjacent districts.
- Remove barriers to privatization, concessions, and other nontraditional models of funding community water systems in conjunction with each state's development of best practice approaches to using these nontraditional finance models in the water sector.
- Allow access of privately-owned water providers to Water Infrastructure Finance and Innovation Act (WIFIA) and US Federal grant programs.
- Support and incentivize regionalization of water systems by reviewing state capacity development policies to ensure beneficial regionalization and modifying current grant allocation formulas to actively promote beneficial consolidation of water systems. "Safe harbor" from regulatory penalties should be given to those systems that absorb troubled systems for a reasonable time period.

INVEST IN INNOVATION

Funding

- Provide funding and construct infrastructure to retrieve water from underground storage (from on farm recharge, injection of treated wastewater, etc.).
- Invest in grant programs or other techniques to promote advanced asset management of water utilities, such as the use of leak detection technologies, and encourage reinvestment of cost savings into new or upgraded facilities.
- Fund NOAA Precipitation Prediction Grand Challenge Strategy and NASA's Earth Science remote sensing tools (particularly the interface between space observations and local data needs).

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- Furnish high speed computational systems to allow for accurate decadal weather forecasting and related modeling that incorporate the effects of climate change.
- Enable water suppliers to try innovative products and practices by minimizing the risk in innovation while maintaining compliance and capacity.
- Provide funding for research in AI and how it can be used as a tool in water resource management.

ASSIST LOW-INCOME AND VULNERABLE POPULATIONS

Support

- Identify and assist at-risk communities where water security can be decimated by non-record weather events (e.g., Jackson, Mississippi's August 2022 extended loss of potable water).
- Expedite Native American water rights settlements in lieu of adjudication.
- Make permanent and increase the funding for programs that aid water customers with delinquent accounts and low-income assistance programs; provide the aid directly to water utilities.
- Assist low-income communities in preventing loss of treated water from leaking pipes and restoring efficiencies to at-risk water systems through Federal investment.
- Address water over-allocation and inequities in water entitlements.
- Invest in critical water infrastructure in those communities which may have outdated systems or no systems.

INCREASE NATIONAL RESILIENCY TO DROUGHT, FLOODS, AND OTHER WATER-RELATED CRISES

Collaboration

- Promote cooperation and transparency between government and non-government entities—including local authorities—and help states and cities adjust and adapt to extended drought conditions, intense precipitation, and flooding.
  - Conduct cross-sector and regional water crisis drills to ensure cooperation and response during extreme events.
  - Eliminate silos between Federal, state, and other agencies.

Flexibility

- Enable the ability to upgrade existing water infrastructure such as reservoirs to increase water storage capacity.
- Allow operational flexibility of Federal water assets to take advantage of wet and dry years.
- Ensure that protocols and processes are in place to face natural and man-made disasters and disruptions in water supply.
  - Create and implement a water industry national standard in cybersecurity that is affordable and attainable by all utilities.
    - Invest in cybersecurity systems at water plants and on military bases.
- Facilitate connectivity of adjacent water systems for water sharing during emergency situations.
- Streamline the Federal Emergency Management Agency (FEMA) emergency process and promote FEMA's hazard mitigation planning process to state, tribal, and local governments.
  - Recommend that FEMA include the Water Sector as an Emergency Support Function under the National Response Framework.
  - Encourage FEMA to allow post-disaster mitigation funding for nontraditional emergencies and to increase funding for the Disaster Relief Fund (DRF).

Reuse

- Remove barriers to inter-basin transfers of water.
- Leverage regional water systems.
  - Provide interconnections to maximize use of available water—move water to where it is needed (regional systems act as raw water wholesalers to local water treatment facilities).
- Promote circularity through water reuse, the use of greywater, underground storage, and the recharge of aquifers through onsite retention of stormwater and other available water.
  - Implement desalination projects (especially on the Gulf Coast).
- Organize large-scale conservation efforts by developing national conservation goals and by integrating Federal, state, tribal, and local conservation programs to ensure the nation's conservation goals are met.
- Incentivize homeowners to install water-saving fixtures and appliances by increasing the limit on Federal tax credits.
  - Increase the limit on tax-free "cash for grass" programs.

INVEST IN THE WATER INFRASTRUCTURE WORKFORCE

- Expand workforce development and training programs such as the EPA's Innovative Water Infrastructure Workforce Development Grant Program to find and train the next generation of water facility operators.

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Workforce Pipeline

- Broaden the EPA's America's Water Sector Workforce Initiative to include workforce needs across the entire water sector.
- Focus on diversity and inclusion to create a pipeline of workers. Half of all Americans do not have a post-high school credential, so remove barriers such as lack of access to funding (i.e., Pell Grants), childcare, transportation, and workforce housing.

Mitigation of Cross-Sector Impacts Due to the Water Crisis

In this section, the NIAC focused on four sectors that depend on water: energy, agriculture, inland waterway transportation, and flood control. See full report for description of other sectors reliant on water.

WATER AND ENERGY

Nexus

Water and energy are inextricably tied to one another. The water/energy nexus is critical for the production and delivery of each to the other. Recognizing this nexus and its importance with respect to economic development must be part of any recommendation and ultimate solution.

Energy production heavily relies on water for generating electricity and is the biggest user of water. However, the generation of electricity does not consume an appreciable amount of water but returns the vast majority to the system after use. The amount of water used for the cooling of power-generating equipment has been increasing due to increasing temperatures, particularly due to increased nighttime temperatures. Thermal and hydropower plant efficiency and generation capacity is reduced by drought conditions. Drought or low water river conditions also impact the supply chain for fuel availability and delivery.

Renewable Impacts

As states transition to carbon neutrality, the decommissioning of coal-burning plants is under consideration. Water insecurity, especially in western, environmentally progressive states, is causing the older fossil fuel assets to remain in place, since hydropower generation is being reduced during periods of water scarcity. With time, renewable energy will become a higher percentage of the total electricity provided. Until electric storage technologies become more robust and come online, dispatchable generation will become increasingly important because it fills the generation gaps that occur at sunrise, at sunset, on windless nights, and on cloudy days.

New sources of energy can also be big consumers of water. Green hydrogen uses clean energy to electrolyze water, thus consuming water by converting it to hydrogen and oxygen. The other types of hydrogen production are less green, but most use steam in the chemical process of creating hydrogen. Water will play a key role in attaining carbon neutrality, further increasing the strain on the nation's water resource infrastructure.

Conversely, as much as 40% of operating costs for drinking water systems can be for energy. The pumping of raw or finished water is energy intense. One of the largest cost and capital components is the actual delivery of water through underground infrastructure which, as stated, is in poor shape.

THE AGRICULTURAL SECTOR

Food Production

Agriculture is the second biggest user of water, behind the energy sector. The US is a major agricultural producer and is considered the breadbasket for the world. The US produces about 30% of all corn and 35% of all soybeans grown globally, and it provides 55% of the world's almonds and 37% of its pistachios. So, it is not surprising that agriculture is the second biggest user of water and the biggest consumer of water. According to the USDA, the top five states ranked by irrigated acres are Nebraska (14.8%, increasing), California (13.5%, decreasing), Arkansas (8.4%, increasing), Texas (7.5%, decreasing), and Idaho (5.9%) (https://www.ers.usda.gov/topics/farm-practices-management/irrigation-water-use/). The listed percentage is of the total irrigated land.

More than half of irrigation water (55%) comes from surface water, and 45% of irrigation water is from groundwater. Surface water irrigation is most common in the western states where Federal reclamation policy and state investment in irrigation infrastructure make surface water accessible to irrigated land. Groundwater withdrawal for irrigation is usually managed by local irrigation organizations. Irrigated agricultural production supported by groundwater use is concentrated over three aquifer systems (the Central Valley, High Plains, and Mississippi Embayment), with unsustainable groundwater depletion increasing over the last thirty years. Irrigation withdrawals of surface water from Lake Mead and Lake Powell are major contributors to the depletion over the last two decades of these stored water assets.

THE INLAND WATERWAYS: TRANSPORTATION

The nation's inland transportation system relies on water. The Mississippi River's inland waterways overlay America's (and arguably the world's) most productive farmland, providing the US an agricultural competitive edge. It is the only transportation system with the capacity to handle moving the projected

US Infrastructure

increase in agricultural, energy, and manufacturing products to the coast for export. This is dependent on the reliability of the inland waterways transportation system to move bulk freight. Over 92% of the nation's agricultural exports and 78% of the world's feed grains and soybean move by barge on the inland waterways annually, often closing the gap between total US imports and US exports.

Logistics

The inland waterways system also supports industries that rely on rivers—indirectly contributing to job growth in the agriculture, manufacturing, and energy sectors—while directly supporting towboat operators and skilled labor trades. The inland waterways navigation system, along with railways and highways, provides a multimodal network that enables freight movement and reduces congestion along roadways and rail lines. This integrated transportation system enhances the overall efficiency and effectiveness of the nation's logistics infrastructure. In addition, barge transportation has a significantly lower carbon footprint than other modes of transportation and reduces highway congestion.

Design Life

The average age of US dams is 60 years, and many waterway assets have reached the end of their design life. Single locks present a single point of failure for movement of barge traffic and are not sized for today's barge tows so that tows must break into two parts to traverse locks on the system. The IIJA provided $2.5 billion for construction and major rehabilitation of inland water projects although there is a $6.8 billion backlog of construction projects and an estimated $13 billion funding needed for complete modernization. Projects along the inland waterways system yield a substantial return on investment due to the movement of bulk commodities and reduction in flood damages.

THE INLAND WATERWAYS: FLOOD CONTROL

Flood Damage

Climate change has challenged inland waterways. In the past twelve years, the Mississippi River system has seen several years of historic record flows alternating with record low water flows caused by climate variability. Low water flows threaten navigation, requiring releases from dam reservoirs, an increase in dredging due to sediment carried by the energy of the river at high discharge, and a reduction of freight loaded on barges to reduce barge draft. Record high discharge often causes riverine flooding of communities, industry, and farmland and causes economic damages associated with record flooding as well as damages to the system itself.

Enhancing the infrastructure of the inland waterways' navigation system improves natural disaster resilience. The waterways serve as alternative transportation routes should roads, railways, or pipelines become inaccessible or compromised. In natural disasters and major flood events, the system's levees and dams are used to manage floodwaters and are damaged in the process.

Recommendations to Mitigate Cross-Sector Impacts

INVEST IN RELIABLE ENERGY INFRASTRUCTURE IN US RIVER SYSTEMS

Dams

- Support the rehabilitation of dams and reservoirs through increasing funding of grant programs—such as FEMA's Rehabilitation of High Hazard Potential Dams Program—and through revising or deviating from policies that remove barriers to the rehabilitating existing dams and reservoirs that serve public health and safety.
- Maintain hydropower generation through incentives and programs—such as Department of Energy's Maintaining and Enhancing Hydroelectricity Incentives and IIJA's Hydroelectric Production Incentives.

Data

- Monitor drought and river levels.
  - Increase the number of point measurement such as river gauges.
- Increase drought prediction and forecasting capabilities so that electric utilities can estimate future conditions.

Coordination

- Create a unifying entity that allows for more coordination between electric assets upstream and downstream about each other's water usage that balances the need for sharing data with security concerns (similar to the Water Information Sharing and Analysis Center).
- Provide more structural assessments of water versus energy demand to aid in system efficiency and delivery through the Energy Information Administration.
- Remove barriers to the placement of hydropower on existing US dams when placement is feasible (some dams are authorized for flood control or another single purpose and can be equipped relatively easily for additional power generation through the installation of turbines and the associated facilities).

Research

- Invest in interdisciplinary and applied research.
  - Promote the use of reclaimed wastewater for thermoelectric power cooling needs.
  - Increase efficiency of cooling technologies to offset energy demands from increasing temperatures because of climate change.

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Management

Investment

Efficiency

Support

Long-Term Strategy

MODERNIZE AND MAKE FLOOD RESILIENT THE INLAND WATERWAYS TRANSPORTATION SYSTEM

- Integrate multiple benefits as opposed to a single benefit into feasibility studies and investigations for new inland waterways projects, and always address flood risk.
- Allow supplemental appropriations to be used to fund mitigation and resiliency post disaster.
  - Increase FEMA's Building Resilient Infrastructure and Communities (BRIC) funding.
- Use forecast-informed reservoir operations (FIRO) strategies to better respond to atmospheric episodes by either retaining or releasing water from reservoirs per forecasted weather.
- Incorporate modern information systems into flood control/risk management.
- Update water control manuals and operating rules of large inland waterway infrastructure to better handle climate variability.
- Continue to invest in the modernization of the US Army Corps of Engineers (USACE) assets (e.g., dredges, survey vessels, new survey technologies) that are critical for maintaining operational waterways during water crisis events (e.g., for quick response to actual and emerging high or low water flow along the Mississippi River).
- Develop a prioritized investment plan for locks and dams with focus on the highest priority transportation (both current and future) needs along the marine highways. Replace aging locks with larger dual locks on the Mississippi and Ohio Rivers when justified by usage.
- Increase national dredging capacity due to increased dredging needs driven by climate change, sea level rise, and new/emerging industrial needs such as offshore wind and increased use of green infrastructure. Strike the best balance between supporting a robust private fleet and ensuring sufficient USACE-owned assets.
- Leverage the water power available at dams along rivers to support clean energy power/fuel needs for decarbonized marine operations on the rivers.
- Fund programs monitoring and forecasting snowpack related to potential flooding on the Mississippi and Missouri Rivers, Ohio Valley, and into the Great Lakes region.

SUPPORT ADAPTIVE PRACTICES AND PROMOTE SMARTER IRRIGATION TECHNOLOGY

- Incentivize the planting of less water-intensive crops by farmers in areas of water scarcity.
- Support drip irrigation and other ways to apply irrigation of water efficiently.
- Promote USDA's Climate Hubs which, in conjunction with partner entities, offer strategies, management options, and technical support to farmers, ranchers, and forest landowners to help them adapt to climate change.
- Reform crop insurance to incentivize climate adaption by farmers.
- Develop a comprehensive, objective national drought index. Include reservoir levels, aquifer status, in-situ soil moisture measurements to validate model predictions, potential moisture stored in snowpack, and a measure of the temporal distribution of precipitation.
- Prioritize drinking water over agriculture water during drought emergencies; agriculture water used for drinking purposes should be compensated post-disaster.

A National Water Strategy

Water is an essential and primary need of every American, yet most Americans take water for granted. Local water suppliers are dealing with aging, obsolete infrastructure, a challenged and shrinking workforce, and compliance with regulations of increased scope. New regulations (e.g., PFAS) will require upgrades to water treatment facilities, during a time of supply chain issues, regardless of whether the utility is large, well-managed, and financially secure or a small provider of water to a marginalized community.

Our raw water supply is being threatened by changes in weather patterns. Erratic precipitation and the associated uncertainties in long-term forecasting and hydrologic modeling make the retrofitting and remodeling of major water supply infrastructure of Federal interest a challenge.

The regionalization of water will require Federal action. The US has an outward facing Global Water Strategy, but no five-year or long-term national strategy. Water resources are managed by a variety of Federal agencies, with little coordination among them. This fragmentation of responsibility at the Federal level makes it difficult to ascertain the country's water needs and strategically prepare the nation for a water-secure future.

A regularly updated national water strategy would identify challenges to the nation's water assets, unify the efforts of all Federal agencies, and partner with state, tribal, and local governments so that the national water resources can provide for the country's needs today and in the future by developing required goals and measures while balancing the competing priorities and interests of other sectors.

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Recommendations

RECOMMENDATIONS TO CREATE A NATIONAL WATER STRATEGY

1. Elevate the importance of water in the national consciousness through a public awareness program.
2. Institute either a Department of Water or some other entity that stewards water at the Cabinet level (see complete report for more details).

Conclusion

Following receipt of the NSC's tasking, and over the course of five months, the NIAC pulled its network of resources from across the critical water infrastructure industry to share challenges faced in the evolving water crisis. The result is the identification of 14 challenges as well as 12 recommendations which the US Federal government can use to help critical owners and operators prepare for the rapidly evolving water crisis. The NIAC urges the President to consider these recommendations for immediate and long-term implementation to improve the nation's critical water infrastructure resilience, security, and accessibility through increased investments, standards, and attention.

For Additional Information: https://www.cisa.gov/niac

WATER BRIEFS

LAND-USE COLLABORATION LA

MIRABEAU WATER GARDEN

Ten years ago, Greater New Orleans, Inc. (GNO) released the Urban Water Plan, putting forward a vision of "living with water" and various "demonstration projects" for potential implementation. Early Dec. 2023, ground was broken, and blessed, on the Mirabeau Water Garden, a capstone demonstration project in the plan.

The plan's Urban Design Report provided initial cost estimates and schematic design for Mirabeau. The report proclaimed, "The twenty-five-acre parcel remains as one of the only large parcels in the city of New Orleans under single ownership, the Sisters of St. Joseph. This site can become both a replicable example of water management for the lowland landscape, as well as an educational destination for residents to learn of water filtration and management."

At the time, the Sisters of St. Joseph wished to "partner with others to facilitate systemic change." The Vision Report foresaw this change: "A system of wetland terraces, rain gardens, bioswales, and a woodland wash provide diverse habitats for native flora and fauna, as well as for educational programming for local schools.

The ambitious design diverts runoff from a Sewerage & Water Board pipe, infiltrating it into the sandy substrate of the Pine Island Beach Trend and filtering it for use in recreational and ecological features. Ultimately, the site would serve "memorialization, education, filtration, and recreation for the neighborhood and the region."

Now, this vision is becoming a reality, and Mirabeau will be a "model for lowland water management" following a 18-24 month construction period. Mirabeau will capture 10 million gallons of stormwater, which will reduce volume of water entering the London Avenue Canal at Pump Station #4, thus making Pump Station #3 more effective. The project will feature nearly 600 trees, of seven different native trees species, and over 5,000 container plants, and over 26,000 plugs of grass species. The $31M project is expected to yield an economic impact of $210M in avoiding flooding losses, business interruption, and urban heat reduction.

GNO, Inc. recognizes all those involved in the original Urban Water Plan, and all those involved in subsequent project planning, development, and delivery. These partners including federal agencies, the City of New Orleans, Waggonner & Ball Architects/Environment, CARBO Landscape Architects, M.R. Pittman Construction, and many more private and public water sector leaders. GNO, Inc. finally thanks the Sisters of St. Joseph for their lasting commitment to resilience and faith in the Greater New Orleans Region.
FOR INFO: https://www.gnowater.org/

WATER & ENERGY NM

NEW REUSE STRATEGY

At the 2023 United Nations Climate Change Conference on Dec. 5, Gov. Michelle Lujan Grisham announced a first-of-its-kind strategic water supply to increase drought resilience and advance clean energy production and storage.

The strategic water supply will support the nation's transition to renewable energy by providing resources for water-intensive processes around creating green hydrogen, storing energy produced by wind and solar, and manufacturing electric vehicles, microchips, solar panels, and wind turbines, for example.

"In arid states like ours, every drop counts. A warming climate throws that fact into sharper relief every day," said Gov. Lujan Grisham. "This is innovation in action: We're leveraging the private sector to strengthen our climate resiliency and protect our precious freshwater resources."

Global warming and aridification are exacerbating water shortages throughout the Southwestern United States. Consequently, some reservoirs and groundwater supplies are critically low and not recharging at sufficient rates to ensure future water security. In Albuquerque, the Rio Grande went dry for the first time in four decades in August 2022. Such events illustrate how current water supplies are not matched for future demand, where climate models predict up to a 25% reduction in available water across the state.

Through a $500 million investment, New Mexico will purchase treated brackish and treated produced water to build the strategic water supply. In early 2024, the New Mexico Environment Department will issue guidance and seek proposals from companies interested in pursuing a contract. This contracting model, used in other industries like healthcare for manufacturing vaccines, is known as an advanced market commitment. Advanced market commitments reduce the risk of private sector investment and spur first movers to build otherwise costly infrastructure.

Companies that are awarded an advanced market commitment contract can secure private capital to build and operate water treatment facilities with the assurance the State of New Mexico will purchase the water. Then, the state will make the water available for creating green hydrogen; storing energy produced by wind and solar; manufacturing electric vehicles, microchips, solar panels, and wind turbines; and other uses as treatment and demand allow.

New Mexico sits atop substantial aquifers of brackish salt water, which cannot be used for human or agricultural consumption without treatment. Brackish water supplies are separate from freshwater resources underground. Estimates indicate there may be between two and four billion acre-feet of brackish water underneath New Mexico. A 25 million gallon-per-day brackish water treatment plant could produce up to 27,900 acre-feet of potable water a year. For comparison, this would cover approximately 70% of the annual consumptive water use in the Albuquerque area, which is roughly 40,000 acre-feet.

In addition, over 2 billion barrels of produced water were generated by oil and gas operations in 2022, of which 1.2 billion barrels were simply injected into deep wells for permanent disposal in New Mexico. Diverting just 3% of the produced water disposed of in injection wells to make hydrogen could result in enough energy to fully power over 2 million homes annually.

Gov. Lujan Grisham will seek the $500 million in non-general fund dollars. This includes $250 million to be appropriated in the upcoming legislative session and $250 million in the 2025 legislative session. This funding is secured through revenues from severance taxes collected on oil, gas, and other natural resources that are "severed" from the ground.

Strategically locating brackish and produced water treatment facilities around the state can offset demand for freshwater. In the future, the development of science-based regulatory standards may allow for expanded uses of treated water from the strategic water supply.

The governor made the announcement at a US Chamber of Commerce event titled "Business Leadership on the Global Stocktake: Catalyzing Investment while Prioritizing a Just Transition."

The New Mexico Environment Department recently requested public comments on proposed water reuse rules. Once finalized, the water reuse rules will create a consistent and science-based permitting program to attract more investment in water reuse. All treated water must comply with New Mexico Environment Department regulations and permitting requirements.

The New Mexico Environment Department will provide a detailed roadmap for companies to express interest in pursuing an advanced market commitment contract with the State of New Mexico after the legislative session concludes in February 2024.

FOR INFO: https://www.governor.state.nm.us/wp-content/uploads/2023/12/2023-12-05-Governor-Lujan-Grisham-announces-Strategic-Water-Supply.pdf

LEAD PIPE STANDARDS US

GET THE LEAD OUT

On Nov. 30, the US Environmental Protection Agency (EPA) announced a proposal to strengthen its Lead and Copper Rule that would require water systems across the country to replace lead service lines within 10 years. EPA is also proposing additional improvements to protect public health, such as lowering the lead action level and improving sampling protocols utilized by water systems. The proposed action significantly advances President Biden's commitment to remove every lead service line in America to protect children and vulnerable populations from the negative impacts of lead in drinking water, particularly those living in disadvantaged communities.

The Biden-Harris Administration is using every tool available to help communities and water systems Get the Lead Out—including investing a historic $15 billion through the Bipartisan Infrastructure Law to replace lead service lines, providing technical assistance to communities, and supporting the development of a national inventory of lead service lines. The Lead and Copper Rule Improvements are central to the whole of government approach detailed in the Administration's Lead Pipe and Paint Action Plan.

The science is clear: there is no safe level of lead exposure. In children, it can severely harm mental and physical development—slowing down learning and damaging the brain. In adults, lead can cause increased blood pressure, heart disease, decreased kidney function, and cancer.

The proposed Lead and Copper Rule Improvements are a major advancement in protecting children and adults from these significant, and irreversible, health effects from lead in drinking water. Key provisions in the proposal include:

- Achieving 100% Lead Pipe Replacement within 10 years.
- Locating legacy lead pipes.
- Improving tap sampling.
- Lowering the Lead Action Level.
- Strengthening protections to reduce exposure.

The proposal would also require water systems to communicate more frequently and proactively with consumers about lead service lines and the system's plans for replacing the lines.

Once the proposed rule is published in the Federal Register, EPA will accept comments for 60 days. The agency will also hold a virtual public hearing on January 16, 2024, at which time the public will be invited to provide EPA with verbal comments.

FOR INFO: https://www.epa.gov/ground-water-and-drinking-water/proposed-lead-and-copper-rule-improvements

TECHINCAL FUNDING US

SMALL & RURAL SYSTEMS

The US Environmental Protection Agency (EPA) announced the availability of up to $30.7 million in grant funding for technical assistance and training to support small drinking water and wastewater systems, including those in rural communities. This grant provides funding to organizations that work side by side with water systems by giving them the necessary tools and training to ensure communities have safe drinking water and effective wastewater treatment systems.

Small water systems often face unique financial and operational challenges, including aging infrastructure, workforce shortages, increasing costs, and declining rate bases. Many small systems also serve disadvantaged communities with environmental justice concerns. With this action, EPA is investing in small and underserved communities to ensure safe drinking water and wastewater services are provided to those that are most in need.

Additionally, this grant will help expand on the Agency's water technical assistance commitment, which aims to provide a range of assistance to help communities identify solutions for water challenges—from capacity building to helping navigate

the federal funding application process, and strategically investing in reliable infrastructure solutions.

EPA is seeking applications to fund grant projects that will benefit small and rural communities. Eligible applicants for this competitive agreement are nonprofit organizations, nonprofit private universities and colleges, and public institutions of higher education. The application period for these competitive grants is now open.

Questions about applying for EPA funding for training and technical assistance must be received by January 18, 2024 and applications must be received by 11:59 p.m. EST on February 2, 2024. EPA expects to award these cooperative agreements by summer of 2024 and encourages all eligible organizations who have an interest in these projects to apply.

FOR INFO: https://www.epa.gov/dwcapacity/training-and-technical-assistance-small-systems-funding

CONSERVATION PLAN CA

IMPERIAL IRRIGATION DISTRICT

As part of the historic Lower Basin Plan between Arizona, California, and Nevada to conserve 3 million acre-feet of water by 2026 to protect the Colorado River system from extended drought, the Imperial Irrigation District (IID) Board of Directors met on Dec. 1, unanimously approving the 2023 System Conservation Implementation Agreement (SCIA) with the US Bureau of Reclamation. This landmark agreement signals IID's commitment to the sustainability of the Colorado River, crucial to the Imperial Valley as its sole source of water.

The agreement also triggers the release of $70 million from an available $250 million in federal funding earmarked last year for environmental projects to support the Salton Sea.

Under the SCIA, IID pledges to conserve up to 100,000 acre-feet of water in 2023, raising Lake Mead's elevation behind Hoover Dam by 1.5 feet. This responsive action is a component of the broader May 2023 Lower Basin Plan, which Reclamation identified as the proposed action for near-term operations of the river resulting from the June 2022 call to action by Reclamation for Colorado River water users to develop near-term plans to reduce consumptive use and safeguard critical reservoir elevations.

The conserved water, generated entirely through IID's On-Farm Efficiency Conservation Program, exemplifies the outstanding efforts of Imperial Valley growers. About half of the conservation, 50,000 acre-feet, initially designated for transfer to the San Diego County Water Authority (SDCWA) will now instead remain in Lake Mead as a result of an innovative three-party agreement between IID, SDCWA, and The Metropolitan Water District of Southern California, benefiting the entire basin through collaborative partnerships and funded at current rates through the Inflation Reduction Act.

IID, holding some of the most senior and legally protected water rights on the Colorado River, annually conserves approximately 500,000 acre-feet of water under the Quantification Settlement Agreement (QSA), the nation's largest ag-to-urban water conservation and transfer pact.

Coordination for conservation efforts beyond 2023 continues, with IID proposing a cumulative target of 800,000 acre-feet of additional conservation by 2026. The district has initiated an environmental compliance process for 2024-2026 conservation efforts and is working with agricultural stakeholders and Reclamation to finalize new conservation programs to generate this volume.

The IID's commitment extends beyond water conservation, with a focus on supporting the Salton Sea as its leading advocate. Collaborative efforts, as outlined in the historic agreement between Reclamation, the California Natural Resources Agency, Coachella Valley Water District, and IID in December 2022, designated $250 million in funding from the Inflation Reduction Act for state projects contributing to the Salton Sea's restoration.

FOR INFO: Robert Schettler, Public Information Officer, 760/ 427-5264

TRIBAL CONSULTATION US

REVISED POLICY

On Dec. 7, the US Environmental Protection Agency (EPA) released the revised EPA Policy on Consultation with Indian Tribes and the companion Guidance for Discussing Tribal Treaty or Similar Rights, reflecting the Biden-Harris Administration's commitment to strengthening Nation-to-Nation partnerships.

EPA has long been at the forefront of developing policy that ensures consideration of Tribal interests in making agency policy and managing environmental programs affecting Indian country. In 1984, EPA became one of the first federal agencies to develop a policy for interacting with Tribal governments, laying out how to consider Tribal interests in carrying out its programs to protect human health and the environment. In 2011, EPA was among the first federal agencies to issue a Tribal consultation policy and has since conducted more than 900 Tribal consultations. In 2016, EPA developed the Guidance for Discussing Tribal Treaty Rights, the first of its kind for any federal agency. Complementary to the consultation policy, EPA provides training to staff on working effectively with Tribal governments. Successful implementation of EPA's Consultation Policy is a top priority for the Agency.

The current revisions were initiated by President Biden's January 26, 2021 Memorandum on Tribal Consultation and Strengthening Nation-to-Nation Relationships, which asked each federal agency to ensure regular and meaningful consultation with Tribal officials. EPA's revisions incorporate standards developed by the White House and interagency workgroups to promote uniformity in the way the federal government conducts consultation with federally recognized Tribal governments. The finalized policy and guidance additionally reflect valuable input from Tribal officials and Tribal partnership groups. Key revisions include:

- Guiding principles addressing the consideration of Indigenous Knowledge and information regarding sacred sites;
- Additional specificity on consultation timing, notification, coordination, participants, and follow-up;
- A section titled "Consultation Process Review" providing a means to resolve Tribal concerns of the sufficiency, timing and agency compliance with consultation policy requirements; and
- Expanded scope of the Guidance for Discussing Tribal Treaty Rights to include additional instruments of federal law and to apply to national EPA actions.

FOR INFO: https://www.epa.gov/tribal/consultation-tribes

CALENDAR

January 17 WEB

Building Climate Resilience: Transforming Communities through Green Workforce Development, Virtual. Presented by Urban Waters Learning Network. For info: https://urbanwaterslearningnetwork.org/

January 17-19 KS

Kansas Ground Water Association 76th Annual Convention and Trade Show, Mulvane. Kansas Star Event Center. Presented by Kansas Ground Water Association. For info: https://www.kgwa.org/event-5392166

January 18 TX

Water in the Desert: Water in the Chihuahuan Desert of West Texas, Alpine. Sul Ross State University. For info: https://bri.sulross.edu/events/water-in-the-desert-2024/

January 23-24 AL

National Hydro-Power Association Southeast Regional Meeting, Auburn. Hotel at Auburn University and Dixon Conference Center. Presented by National Hydro-Power Association. For info: https://www.hydro.org/event/2024-nha-southeast/

January 23-25 WEB

Water Transmission Pipeline Engineering and Management, Virtual. For info: https://www.euci.com/event_post/0124-water-pipeline/

January 23-26 TX

Texas Ground Water Association 2024 Annual Convention and Trade Show, San Marcos. San Marcos Hotel & Conference Center. Presented by Texas Ground Water Association. For info: https://web.tgwa.org/atlas/events/2024-tgwa-annual-convention-5/register

January 24 WEB

The Water-Food Nexus in Mountain Systems, Virtual. Presented by Daugherty Water for Food Global Institute. For Info: https://unl.zoom.us/webinar/register/WN_IfaF8v6cTuydopxQZKrNMg#/registration

January 25 WEB

Southwest Basin Roundtable - January 2024, Virtual. Presented by Colorado Water Conservation Board. For info: https://cwcb.colorado.gov/events/southwest-basin-roundtable-january-2024

January 28-31 MN

MWWA 102nd Annual Convention and Trade Show, Alexandria. Arrowwood Resort and Conference Center. Presented by Minnesota Water Well Association. For info:https://mwwa.org/event-5416359

January 29 - February 1 NV

2024 NWRA Annual Conference Week Events & Activities, Las Vegas. Tuscany Suites & Casino. Presented by Nevada Water Resources Water Association. For info: https://na.eventscloud.com/ereg/index.php?eventid=670655&

January 31 - February 2 CO

Colorado Water Congress Annual Convention, Denver. Aurora-Denver Conference Center. Presented by Colorado Water Congress. For info: https://www.cowatercongress.org/

January 31 - February 2 MT

MWWDA 79th Annual Convention and Trade Show, Fairmont. Fairmont Hot Springs Resort. Presented by Montana Water Well Drillers Association. For info: https://www.mwwda.org/event-5419733

February 5 CA

American Groundwater Trust Water Well, Pump & Water Treatment Workshop, Lakewood. The Centre at Sycamore Plaza. Presented by American Groundwater Trust Water Well, Pump & Water Treatment Workshop. For info: https://agwt.org/civicrm/event/info?id=371&reset=1

February 6-7 CA

25th Annual AGWT–AGWA CA Groundwater Conference, Ontario. Ontario Airport Hotel. Presented by American Groundwater Trust California Groundwater Trust. For info: https://agwt.org/civicrm/event/info?id=372&reset=1

February 6-8 ND

38th Annual Water EXPO, Fargo. Delta Hotels by Marriott. Presented by North Dakota Rural Water Systems Association. For info: https://www.ndrw.org/water-expo/attendees/

February 8-9 NV

Mountain States Groundwater Expo, Laughlin. The Aquarius Casino Resort. Presented by the Groundwater and Water Well Associations of AZ, CO, NV, NM, and UT. For info: https://mountainstatesgroundwater.com/

February 13 WEB

Regulatory Compliance for Water and Wastewater Systems, Virtual. For info: https://www.euci.com/event_post/0224-water-regulatory-compliance/

February 13-16 TX

2024 Winter Conference of National Assoc. of Clean Water Agencies, Austin. Hilton Austin. Presented by National Association of Clean Water Agencies. For info: www.nacwa.org/conferences-events/

February 13-16 OR

The Utility Management Conference, Portland. Oregon Convention Center. Presented by the Water Environment Federation and the American Water Works Association. For info: https://www.wef.org/events--education/conferences/utilitymanagement2024/

February 15-16 IL

IAGP 96th Annual Convention and Trade Show, East Peoria. Embassy Suites by Hilton East Peoria Riverfront Hotel & Conference Center. Presented by Illinois Association of Groundwater Professionals. For info: https://www.iagp.org/event-5428191

February 19-21 IL

49th Annual Conference, Des Moines. Community Choice Credit Union Convention Center Veterans Memorial Center. Presented by Iowa Rural Water Association. For info: https://iowaruralwater.org/annual-conference

February 20-22 IA

42nd Annual Technical Conference, Effingham. Holiday Inn/Keller Convention Center. Presented by Illinois Rural Water Association. For info: https://www.ilrwa.org/ATC.html

February 23 CA

The Future of Water, Sacramento. The Elks Tower Event Center. Presented by Ground Water Resources Association of California. For info: https://www.grac.org/events/register/530/pre/

February 24 CA

California Water Law Symposium, San Francisco. University of San Francisco School of Law. For info: https://www.waterlawsymposium.org/

February 26-01 UT

2024 Rural Water Annual Conference, Saint George. The Dixie Convention Center. Presented by Rural Water Association of Utah. For info: https://www.rwau.net/events/rural-water-annual-conference-2024/register

February 29 CA

A Colorado River Roundtable: Solutions for the 21st Century, Riverside-Palm Desert Center. University of California. Presented by American Water Works Association. For info: https://engage.awwa.org/PersonifyEbusiness/Events/AWWA-Events-Calendar/Meeting-Details/productid/222073564

March 4-7 FL

Membrane Technology Conference, West Palm Beach. Palm Beach County Convention Center. Presented by American Water Works Association. For info: https://www.awwa.org/Events-Education/Membrane-Technology

The Water Report
Water Rights, Water Quality & Water Solutions in the West
3615 W. Hills of Gold Dr. Tucson, AZ 85745

CALENDAR

March 5-7 CO

Riparian Restoration Conference: Restoration for the Future, Colorado Mesa University. Presented by RiversEdge West. For info: https://riversedgewest.org/get-involved/events/2024-riparian-restoration-conference-restoration-future

March 5-7 MN

MRWA Water & Wastewater Technical Conference, St. Cloud. River's Edge Convention Center. Presented by Minnesota Rural Water Association. https://www.mrwa.com/technical-conference-attendee-registration/

March 5-8 NV

2024 NvRWA Annual Training, Sparks. Nugget Casino Resort. Presented by Nevada Rural Water Association. For info: https://www.nvrwa.org/2024-nvrwa-conference-registration.html

March 6-8 NV

2024 Land and Water Summit, Albuquerque. Indian Pueblo Cultural Center. Presented by Land and Water Summit. For info: https://www.landandwatersummitnm.org/index.php/registration/

March 7-8 FL

Water Audits and Non-Revenue Water Management, West Palm Beach. Palm Beach County Convention Center. Presented by American Water Works Association. For info: https://www.awwa.org/Events-Education/Water-Audits-and-Non-Revenue-Water-Management?utm_source=higher_logic&utm_medium=email&utm_term=Water%20Audit%20Seminar%20%2D%2012%2F11&utm_content=ce&utm_campaign=seminar_23

March 11-14 CO

WateReuse Symposium 2024: Removing Barriers, Elevating Opportunities, Denver. Hilton Denver City Center. Presented by WateReuse Trade Association. For info: www.watereuse.org

March 12-13 AZ

WRRC 2024 Annual Conference Implementing Water Solutions Through Partnerships, Tucson. University of Arizona Student Union Grand Ballroom. Presented by the Water Resources Research Center. For info: https://wrrc.arizona.edu/conference/2024

March 13-15 DC

Water Power Week, Washington DC. Capital Hilton. Presented by the National Hydro-Power Association. For info: https://waterpowerweek.com/

February 13-15 NV

Lower Colorado River Tour 2024, Las Vegas. Hilton Garden Inn. Presented by Water Education Foundation. For info: https://www.eventbrite.com/e/lower-colorado-river-tour-tickets-771888267587

March 15-16 WA

2024 Pacific Northwest Ground Water Exposition, Vancouver. Hilton Vancouver Washington. Presented by Pacific Northwest Ground Water Association. For info: https://pnwgwa.org/

March 18-19 WA

Northwest Groundwater Conference, Pasco. Holiday Inn Express Hotel & Suites. Presented by American Groundwater Trust Northwest Groundwater Conference. For info: https://agwt.org/civicrm/event/info?id=373&reset=1

March 18-21 CA

33rd Annual International Conference on Soil, Water, Energy, and Air, San Diego. The DoubleTree Mission Valley. Presented by the Association for Environmental Health and Sciences Foundation. For info: https://www.aehsfoundation.org/westcoast

March 27-29 TX

RuralWaterCon 2024, San Antonio. Henry B. Gonzalez Convention Center. Presented by Texas Rural Water Association. For info: https://www.trwa.org/page/rwc24