

New Perspectives on Water Data



Moderated by Stacy Timmons, New Mexico Bureau of Geology and Mineral Resources

Stacy Timmons directs the hydrogeology division and the Aquifer Mapping Program, with the state geologic survey, the New Mexico Bureau of Geology and Mineral Resources, at New Mexico Tech. Working with the Aquifer Mapping Program for the last 15 years, Stacy has worked around the state on hydrologic and geologic research topics and a variety of water data collection and integration endeavors. In 2019, Stacy began serving on both the Water Quality Control Commission and the Interstate Stream Commission and leading the implementation of the Water Data Act legislation.

Stacy Timmons: I'm going to first say that it is hard to follow the previous panel. What a great discussion. I'm not only going to moderate, but I'll also provide an update on how we're handling water data in New Mexico. Thank you all for joining us, and a special thanks to NM WRRI for hosting this conference in this new online format. It's a huge shift from the previous 64 years of conferences, and I am truly impressed with this year's conference. For those of you online here today, engaging with us on this panel, I hope you will send your questions in the comment box. We will try to address them, and you can also reach out to me directly if you would like to discuss New Mexico's water data further.

So, to introduce myself, I'm a hydrogeologist, and I've been working at the state's geologic survey for 16 years. When I think back on how my career in hydrogeology began in the early 2000s, I realize that the first step in building a new research project is to gather data. Of course, in my world, I envisioned going out and collecting field data, making measurements, collecting samples, but really, it often starts with going through existing data on work that has already been done. It surprised me how much time was needed to hunt down that data and make use of it. The difficulty of accessing water data in New Mexico is one of those topics that no one wants to talk about. We seldom acknowledge it; it's like that spooky skeleton in the closet. There were certainly no panels at water conferences that I was aware of that discussed water data. So, I'm excited to have this opportunity.

Fortunately, since the early 2000s, we've made some improvements. We have a wide variety of websites and tools available where we can access data in a variety of forms. These include the Office of the State Engineer's water rights reporting system, the Bureau of Geology's interactive map, where you can obtain information about geology or groundwater data, NM WRRI's statewide water

assessment application, and the New Mexico Environment Department's various portals, including the drinking water portal and the interactive map where there is a ton of water and environmental data. While these websites are handy, I think a lot of us have difficulty trying to answer some of our basic questions: "Is our water safe to drink? Are we running out where I live?" To me, it seems that finding the data you need to answer those basic questions and knowing how to use it requires a bit of training or expertise.

In 2019, New Mexico made a big move to begin facing that challenge, to stare down that skeleton in the closet, and start addressing our water data challenges. We adopted a new statute, the New Mexico Water Data Act, which originated from legislation led by Representative Melanie Stansbury, who we just heard from, and Representative Gail Armstrong, along with numerous other supporters in the legislature and those outside of it (Figure 1). The Water Data Act is a big step toward opening up our state's water data. Essentially, it aims to make water data more accessible and interoperable, and I've been helping to lead this effort with a solid implementation team and extensive collaboration from various state agencies, as well as numerous other water-related data organizations in New Mexico.

For this panel, I am not going to go into the technical details of how this all comes together. What I want to be clear about is that we're not trying to build another database. What we're really trying to do is push a more fundamental paradigm shift in how we share our data. We're not asking people to say, "Stacy, here's my data. Put it in your data portal." Instead, what we're trying to do is help data providers expose their data—data that has been quality checked and that they're comfortable sharing—and provide it in a machine-readable format (Figure 2). Basically, we're asking people to make

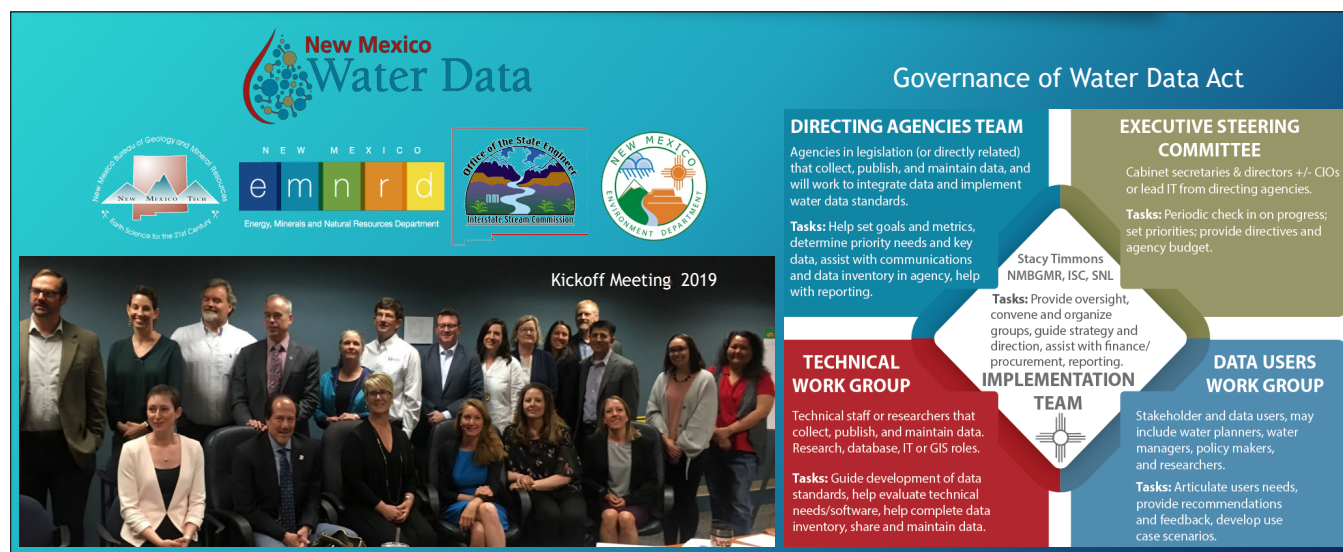


Figure 1. 2019: Water Data Act becomes law (NMSA 1978, § 72-4B).

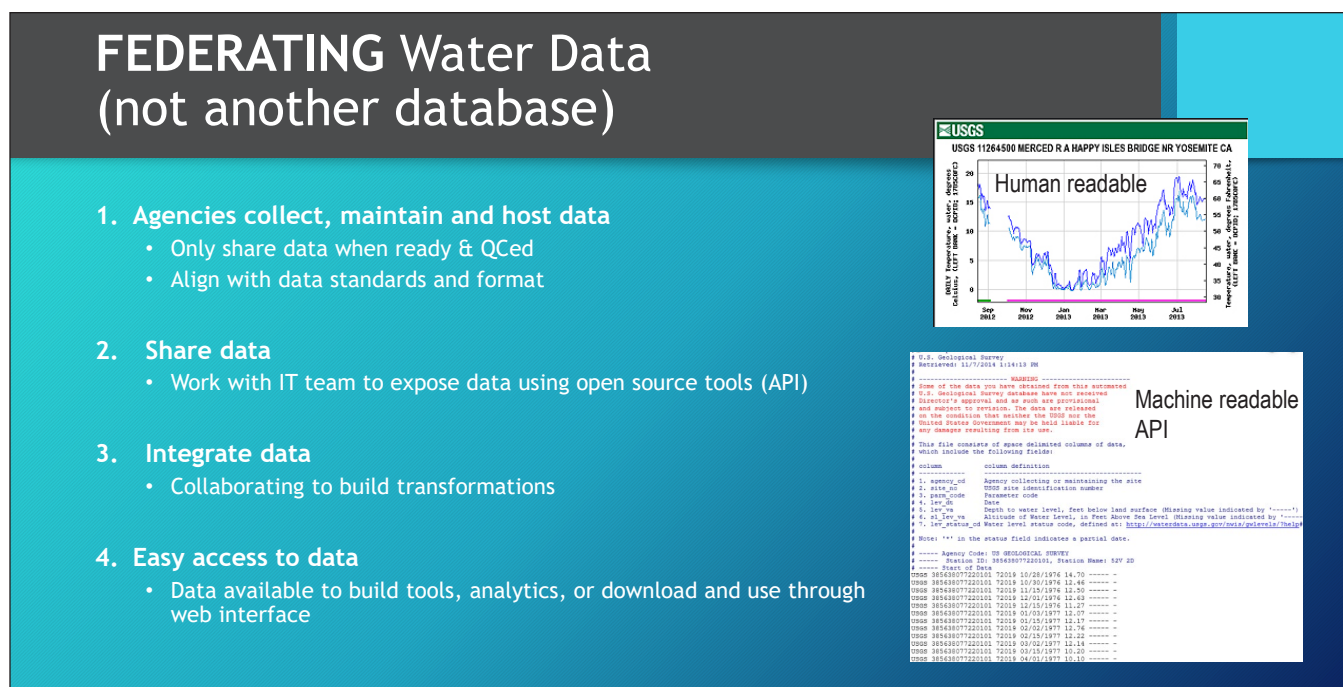


Figure 2. Steps detailing machine-readable actionable programming interface (API).

their data machine-readable and available through an application programming interface (API). From there, we can aggregate the data with other datasets and integrate it with similar data from other agencies. Then it can be used to answer some of those basic questions that people are thinking about. It can also be more readily accessed to improve water models, to aid in water planning, and to help us build a resilient future here in New Mexico in the face of climate change. Additionally, it may help build consensus around some of the big water issues and heated debates. This is a multiyear effort that's well underway now. I acknowledge that a lot of our data is already online in some form, but we're working to make that data even more accessible, particularly in a machine-readable format.

The benefit of this is that it significantly opens our data for use in various tools and applications. A mental picture for that concept is Google Maps, but centered around water themes. The website is newmexicowaterdata.org. Feel free to check it out and provide us with some feedback; we'd love to hear about the type of data you're looking for and how you plan to find it, so we can develop the right tools to help address some of those common questions. We also have a data catalog, where we've started to put together our electronic data inventory. I would like to note that the inventory originated from the State Water Plan, and a significant amount of work went into developing that technical report.

I would like to acknowledge that it has been a great honor to have the opportunity to work on water data for New Mexico. You have to collaborate with various

state agency partners and our different working groups (Figure 3). I've also been impressed with the outreach and engagement we have received in New Mexico to address our water challenges from outside the state, especially from some of the folks on the panel with me today.

I'm going to give a quick intro to the other panelists, and then I'll ask them to begin their presentations. First of all, the Internet of Water has been an absolute pleasure to work with on state water data challenges. New Mexico is one of their first pilots. For those who are unfamiliar, we are greatly benefiting from their team's expertise and knowledge in water data and data architecture. Ashley Ward is going to talk about that here today. The West Big Data Innovation Hub, specifically Meredith Lee, has been a significant supporter of New Mexico's efforts in water data. I'm glad that they've even included New Mexico in their water data challenge hackathon event this year. I am thrilled to be working on this effort with New Mexico Environment Department staff, particularly Gunnar Johnson. We have a data challenge team that's building a tool to help us think about how the changes in the definitions of the waters of the United States are going to affect people on the ground in New Mexico. Then we'll hear from Adel Abdallah, who's here from the Western States Water Council. That group uses a lot of New Mexico's water use data in their Water Data Exchange Program, which I'm sure we'll hear about.

So, first, if you wouldn't mind, Ashley, could you give us a quick introduction to yourself and tell us about the Internet of Water's work on state data?

Partner	Collaboration Description	Website
Internet of Water	New Mexico is a pilot in collaboration with IOW	https://waterchallenge.data.ca.gov/
West Big Data Innovation Hub	New Mexico's first year collaboration with the Water Data Challenge	https://waterchallenge.data.ca.gov/
Western States Water Council	New Mexico's water data feeds to the Water Data Exchange (WADE) portal	www.wade.westernstateswater.org/

Figure 3. Collaboration partners.



Ashley Ward, Internet of Water

Ashley Ward's career has focused on engaging communities to identify and address issues, and helping communities develop long-term, sustainable strategies relevant to their particular community needs. Her previous work with NOAA's Carolinas RISA team connected rural and urban communities and policy decision-makers with relevant climate and health data, particularly related to vulnerabilities and impacts. Engagement with communities across the Carolinas revealed a knowledge and access gap in climate data, wherein many communities did not have the necessary data and expertise to inform decision-making, planning, and preparedness. Ashley and her colleagues at CISA worked with community stakeholders to develop a suite of open-access, web-based tools to address these issues.

Before her work with CISA, Ashley completed her PhD in geography and worked with communities throughout North Carolina on a host of issues, such as local food availability and asset-based economic development strategies. Ashley's passion is building coalitions to advance scientific understanding and communicate information in a way that is relevant for use by decision-makers. Having worked in a broad range of communities with varying levels of capacity, Ashley is particularly thoughtful about meeting communities where they are and working from there to achieve community goals.

Editor's Note: This paper transcribes the panelist's remarks from the conference. No follow-up paper was submitted, and the remarks were edited for publication by the editor. The speaker did not review this version, and the editor assumes responsibility for any transcription or editing errors.

Thanks, Stacy. I am Ashley Ward. I am the engagement and outreach associate with the Internet of Water. The Internet of Water is a project located at Duke University's Nicholas Institute for Environmental Policy Solutions. Our mission is to facilitate a modern water data infrastructure across the United States. No big deal, right? We achieve this through close partnerships with public agencies, like we have in New Mexico, but also through partnerships with nongovernmental organizations, utilities, private industry, and universities. The activities within these partnerships vary and are directly responsive to partner needs. At times, this means that we're developing technical solutions to support the development of a modern water data infrastructure. At other times, it means addressing the cultural aspects of a modernized water data infrastructure, such as concerns over capacity and security, the need to think differently about water data management, as Stacy was just talking about, and the need to demonstrate why investments should be made in improving water data infrastructure.

For today, one of the questions Stacy asked me to think about was how this effort supports research. I've come up with a quick, short list of examples to share with you, and I'm happy to answer any additional questions you may have about these. The first step is improving discoverability of water data. A lot of water data is collected, but little of it is integrated with other data, in part because it is unclear where it is or what's available, or it requires a particular technical expertise to find it. If you want to think about it this way—something completely removed—say you wanted to look up movies playing

in theaters in Albuquerque, New Mexico. You could google "movies Albuquerque," and you would get a list of the movie theaters around Albuquerque. But what if you were in a situation in which you googled "movies in Albuquerque" and what you received instead was an extensive list of random theaters across New Mexico or a broader region, movie reviews, even from old movies, and some interviews from actresses and actors. That would make it a lot more difficult to find the information you need in a timely manner. Before this conference, I googled "Navajo Lake," and I received 9.9 million hits on Google and found all kinds of interesting information about the state park, about camping there, and a Wikipedia article, but no links, at least in the immediate search, to organizations and data sets about Navajo Lake.

Geoconnex is a product being developed by the Internet of Water in collaboration with the U.S. Geological Survey. It is a search index for water data, and operates a lot like a Google search engine for water data. By linking water data to its location, Geoconnex enables the discovery of that data. Currently, when a person googles a specific body of water, relevant data sources may be returned. What Geoconnex hopes to accomplish is that by connecting data with real-world geography, when you google, say, data on Navajo Lake, you would receive a list of any relevant data sources collected about Navajo Lake and surrounding areas, in some cases upstream and downstream (Figure 1). This easing of discovery saves time and facilitates more efficient data acquisition, all without requiring additional technical expertise.

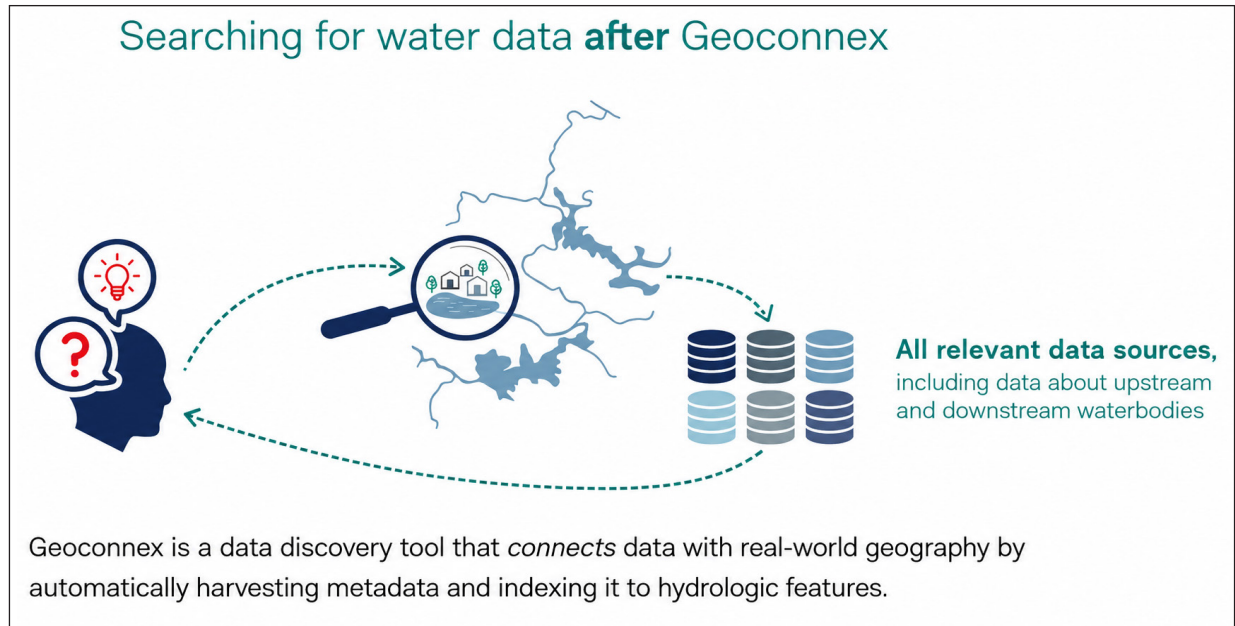


Figure 1. Geoconnex: A search index for water data.

A second issue is fragmentation. Data fragmentation remains a significant issue that not only makes data difficult to find but also very costly to process. HubKit is a data-integration software kit that will be open source, enabling organizations to create their own water data hubs (Figure 2). This is very similar to what Stacy is talking about, which New Mexico is currently doing. The idea behind HubKit is that instead of having to go to multiple locations to get a complete data set, you go to one location, a data hub, that would then connect you to all of those other data sets. This reduces time, saves money, and makes for more efficient data acquisition. Because most of the time water data hubs require certain data standards and metadata standards, it also makes the data-processing end of it much easier for researchers.

I also want to talk a little bit more directly about how modern water data infrastructure can expand and enhance research. For example, one of the tools that we're creating is this ABOUT-US tool (A Boundary Update Tool for Utility Services) for public service boundary areas (Figure 3). The idea behind this tool is to create smart, interactive tools that allow utility managers to edit and update the digital boundaries of their service areas. Now, why is this important? Having access to these digital boundary areas greatly improves the ability to conduct research and support policy efforts. For example, epidemiological research on water contaminant exposure and social science research on infrastructure access disparities are all greatly improved by an accurate delineation between areas served by one water utility or another, or a water utility and those served by groundwater

wells. In North Carolina, up to this point, these studies have relied on outdated pipe location data; however, having digitized service boundaries means that researchers can overlay them on top of other data, potentially opening up a whole new set of questions while also clarifying the questions they're already asking. This is an important area where modern water data infrastructure can be beneficial.

So quickly, to wrap it up, when we think about how a modern water data infrastructure can improve research, we think about not only improving discoverability with more efficient data acquisition, but also improving data processing through data standards and metadata standards and the ability to ask new questions or illuminate more the questions currently being asked because we now have access to integrate data sets with each other in ways that we couldn't before. All of this means that there's an increase in transparency. Also, the emphasis on standards means that there's an increase in trust in data. It's clear through the metadata how the data is collected and managed. It's also clear what the different standards are, and in some cases—if you're thinking about, for example, nongovernmental organization data—the tier for quality assurance/quality control for different data would be obvious and easy for people to find out. So, those are some significant ways in which the Internet of Water project and the promotion of a modern water data infrastructure support research in New Mexico, as well as nationwide, and help researchers in New Mexico connect with others in the region or to broader national efforts. Thanks, Stacy.

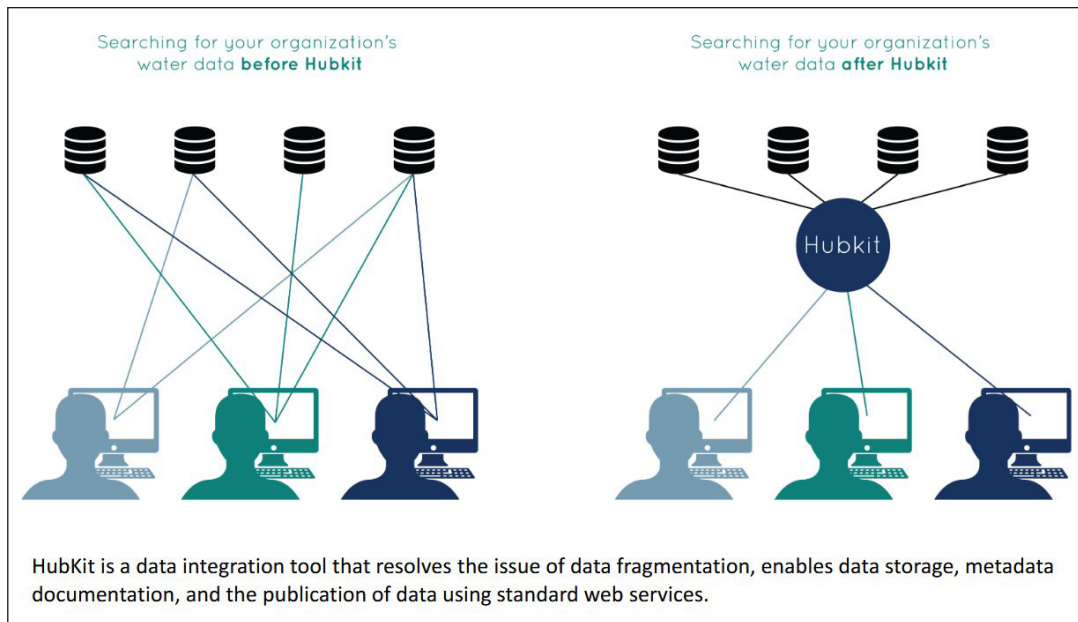


Figure 2. HubKit: Data integration software.

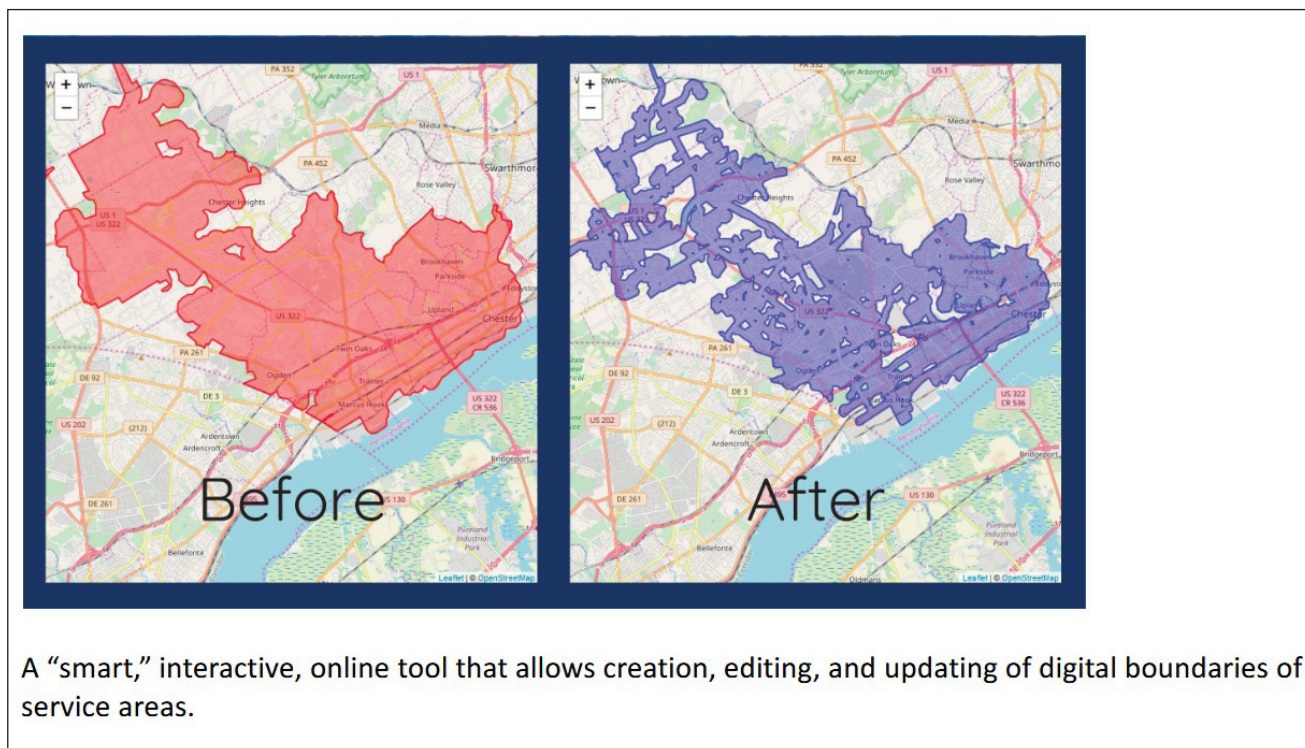


Figure 3. ABOUT-US: A Boundary Update Tool for Utility Services.



Meredith Lee, West Big Data Innovation Hub

Meredith is the Founding Executive Director of the West Big Data Innovation Hub, a venture launched with support from the National Science Foundation to build and strengthen partnerships across industry, academia, nonprofits, and government. Based at the University of California – Berkeley, Dr. Lee collaborates globally as part of a national network of Big Data Innovation Hubs to address scientific and societal challenges. Her work focuses on translational data science, including initiatives in Smart and Connected Communities, Water, Disaster Recovery, Health, and Education.

Meredith was previously an AAAS Science & Technology Policy Fellow at the Homeland Security Advanced Research Projects Agency, guiding strategic programs in graph analytics, risk assessment, machine learning, data visualization, and distributed computing. Under the

Obama Administration, she led the White House Innovation for Disaster Response & Recovery Initiative and contributed to several science, technology, and open data / open government initiatives.

Meredith completed her BS, MS, and PhD in Electrical Engineering at Stanford University, developing real-time biomedical diagnostics. She has taught Human-Centered Design and Innovation at Stanford and in government, and continues to advise organizations with efforts in technology, data science, and multi-stakeholder collaboration. Dr. Lee serves on the Advisory Committee for NASA DIRECT-STEM and the inaugural National Leadership Council for the Society for Science and the Public. Her work has been featured by whitehouse.gov, *ArsTechnica*, *The Washington Post*, *Forbes*, *WIRED*, *Bloomberg*, and *Nature*.

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Thanks so much, Stacy, and to all of the organizers for having me here. I'm always so impressed by the breadth of community perspectives that are convened year after year. I haven't been to all 65 of the New Mexico water conferences, but the ones I have participated in, and really any workshop that this team pulls together, are always super productive. The legislative representatives we just heard from, alongside researchers and community leaders, and the hundreds who are tuning in or watching this, are a prime example of the breadth of collaboration needed. Since my colleague Ashley covered some of the topics of discoverability, data acquisition and processing, research questions, transparency, and trust so nicely, I will take a slightly more meta perspective, but I'm happy to connect offline if folks want more specific details.

The West Big Data Innovation Hub is one of four National Science Foundation Big Data Innovation Hubs in the United States, bridging research, education, and a community of practice. When we launched almost five years ago, we very quickly noted that water physically connects our states in the region. The topic of natural resources and hazards was a compelling area to build activities and initiatives that would allow us to raise awareness of regional opportunities, inspiring new commitments and contributions, like the ones through the water data challenge that Stacy mentioned. The topic allows us to catalyze team formation from a number of different sectors. That's where the accessibility of

water data and the consistent emphasis on bringing in diverse perspectives—centering and valuing different perspectives—is so aligned with the topic of the session and the conference overall. Increasingly, we're digging deeper to develop and enable more translational or applied pilot projects in our thematic areas. This is all held together by this foundational support for data science education, training, and workforce development that is not only incredibly motivating in its own right but also feeds the ecosystem that we build, our capacity to be able to reach all these other goals.

Specifically looking at natural resources and hazards and water efforts, I wanted to reflect that the California Water Data Challenge we've been running now for three-plus years was a unique opportunity, given the timing of the first-in-the-nation legislation in California, the Open and Transparent Water Data Act in 2016 (AB-1755), much like the Water Data Act that Stacy just mentioned (NMSA 1978, §72-4B). The fact that I can rattle those numbers off shows how much we have dived in—pun intended—to the water arena. It's worth noting that state data stewards and communities in California, New Mexico, and other states are considering this broader perspective beyond what's required by the legislation. We see this palpable spirit of collaboration, where we roll up our sleeves to build, test, share, and improve iteratively. I think that enthusiasm and opportunity coming out of the initiative and the Open Data projects can often be quite colorful.

I've been told by some folks that Figure 1 looks nothing like a data policy legislation memo. What's the deal with this? I often refer back to something that Connie Maxwell, who is in the audience and is based at NMSU, said when we were discussing ways to connect with students, particularly underrepresented groups that haven't historically had a seat at the table or had their voices heard. Connie said, "You know, it really boils down to framing this as 'plan your future with data.'" It's a simple concept. We've found that it translates across languages, across disciplinary boundaries. It's incredibly powerful in implementation because it intentionally puts people first, underscoring the sense of agency and recognizing that data is a way for us to assess our current situation as a community, as individuals, and as neighbors, and to prepare for a more resilient future.

That shift, to Stacy's point, in how we share data—I look at it as a bridge toward understanding—has led to

all sorts of great results that we've been able to pursue both nationally and globally. I'm sure you all have seen the 10-year fund for safe and affordable drinking water. We're so excited to have New Mexico's data challenge be part of the 2020 summer and fall tranche. If you know anyone with open data projects, we are offering \$16,000 in different prizes to recognize the teams working toward this challenge this year. In the interest of time, I'll direct you to the Let's Make It Count website (<https://www.letsmakeitcount.org>), noting that it has been a banner year for engagement at all levels, including high school students. We love connecting with New Mexico educators from all different backgrounds. And whether it's around water data or focused on training more community members in data science education as part of this larger network, it has been great to partner with all the New Mexico stakeholders. I'll turn it back to Stacy and Adel now.



Figure 1. California Water Data Challenge illustration.



Adel Abdallah, Western States Water Council

Adel Abdallah served as the Program Manager for the Water Data Exchange (WaDE) program at the Western States Water Council. In this role, he was responsible for overseeing the development and implementation of WaDE 2.0, which aimed to facilitate the sharing of water data among western states, federal partners, and the public. Adel played a key role in enhancing data interoperability and accessibility, collaborating with various stakeholders to improve water management and decision-making processes.

Editor's Note: The Western States Water Data Access and Analysis Tool (WestDAAT) was released publicly in the spring of 2023. More details can be found here: <https://internetofwater.org/blog/unveiling-westdaat-a-breakthrough-for-water-rights-data-management-in-the-western-united-states/>

Thank you. My name is Adel Abdallah, and I manage the Water Data Exchange Program (WaDE) at the Western States Water Council. I have enjoyed the conference so far, listening to the local conversations about water rights. That's really fun for me, coming from a big-picture, regional water perspective. Listening to the local discussions enriches my perspective.

My presentation will still be relevant to the discussions that Meredith and Ashley presented about the regional perspective here. It's amazing to see 150 folks here on the call, and if we were in person, I would ask how many of you are familiar with the Western States Water Council. For those unfamiliar, the Western States Water Council is a voice for water in the West. Its mission is to ensure that the West has an adequate, secure, and sustainable water supply of suitable quality for both the present and the future, meeting diverse water needs. We adopt policy positions on behalf of the western states for Capitol Hill, including voting and other matters. Part of the Western States Water Council's activities is the Water Data Exchange Program that I manage, which was established in 2012 to formulate a strategy or to have a platform to enable western states to share water data with each other and with federal agencies and the public. Many of you probably know that the U.S. Geological Survey (USGS) has a lot of data on surface water discharge. There's the National Ground-Water Monitoring Network, the Bureau of Reclamation water information system, and there's the Environmental Protection Agency's (EPA) water quality data system. The unique part that WaDE brings is water rights data, aggregated water use and budget estimates, site-specific uses and withdrawals from states themselves, and regulatory overlays. None of this data is being, or has been before, provided on a regional scale, so WaDE is coming here to fill the gap.

So, I'll quickly talk about what we do here. We work with every single state agency in the West to bring their data into a centralized database that we built for WaDE, and then we enable centralized access and data portals. We're working with the Internet of Water group to integrate that data with USGS, EPA, and Bureau of Reclamation data services, so you can hopefully accomplish the vision that Ashley laid out, to have Google for water data. Besides the technical aspects, we also attempt to translate water terminology across different states to map data effectively. We have 32 metadata terms that are common across the West. Among these, five are particularly important: beneficial use category, water source type, site type, legal status, and water allocation type. For the beneficial use of water rights, we have approximately 350 unique state terms for beneficial uses, and we have attempted to map them to 22 WaDE terms to facilitate data filtering. For water source types, we mapped 34 state terms to five WaDE terms. These were relatively easy, but the most difficult ones, such as the legal status of a water right or the type of water right, are really challenging because they have legal implications, and we have our legal committee trying to review and come up with these terms. For example, the meaning of the term adjudicated water rights in Wyoming is different from that term in New Mexico, so we're trying to be careful as we provide that data across the West.

Figure 1 is a snapshot of our local dashboard, which is not publicly released yet. It shows water rights across the West. These colors represent the 22 beneficial uses we have identified so far. This is so beautiful to me that what keeps me up at night or gets me up in the morning is enabling regional access to water rights.

We enable research by answering specific questions, such as: What were the water rights for agriculture and

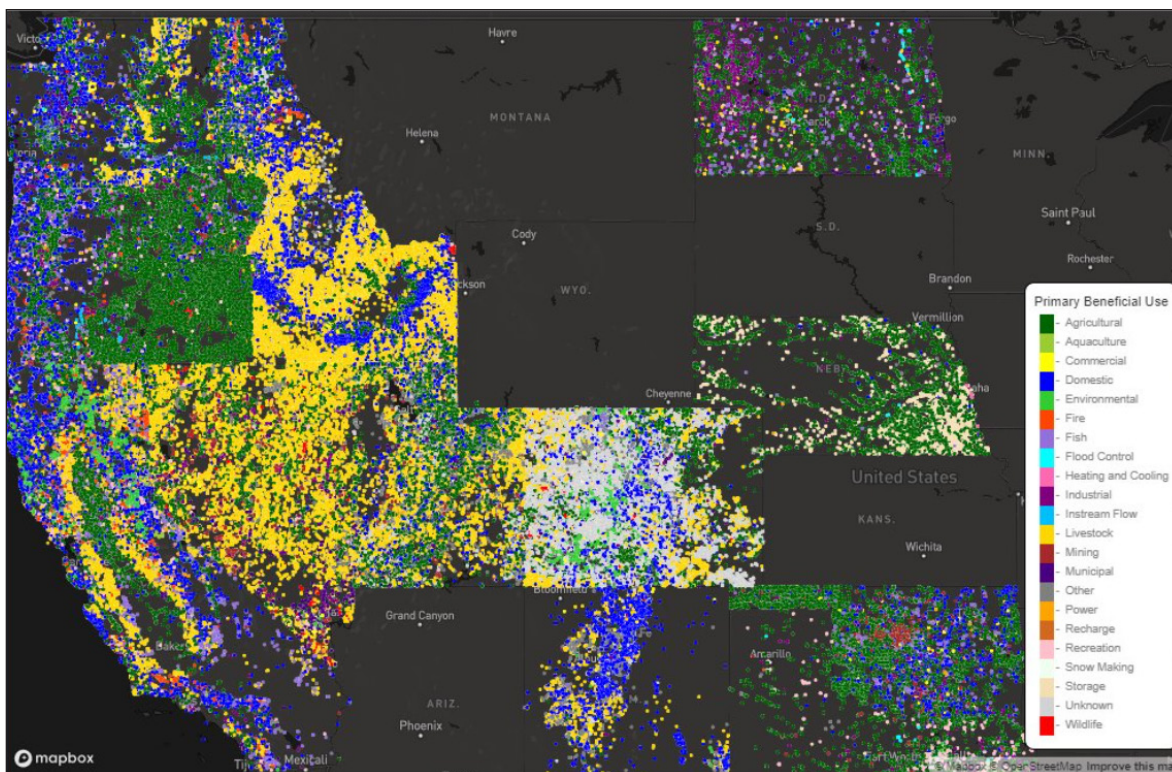


Figure 1. Primary beneficial water use map.

municipal use prior to 1922, the compact date, in the Colorado River Basin? We can clip all these water rights to the Colorado River Basin, and we have a slider bar that allows you to go back in time (Figure 2). The dashboard shows those water rights that are immune if there were to be a call on the river because they are senior to the compact. So, these are some of the policy decisions that such data on a regional scale can inform.

Another type of data I'm discussing today is the aggregate and county water use map, which encompasses nearly all the watersheds in the states (Figure 3). So, New Mexico, for example, estimates watershed data per county, and we report that consistently across the West. Figure 3 shows three states—Texas, Utah, and New Mexico. There are other tabs, including HUCB level or custom watersheds. We have three more states as well. We're trying to fill them out with water use on a regional scale.

Figure 4 shows another example for the Bureau of Reclamation's watersheds, consumptive use for the Colorado. If you click on one of them, it shows a pie chart of where the water is being used, what percentage, and the time series.

The first phase of the WaDE program, spanning the first five years, aimed to establish the program and develop the data system. We're now in the second phase, where we're redesigning a system to focus on use cases to support research questions like the one I showed about the Colorado River Basin. We're looking to release, in the third phase, a public portal that will allow anyone to answer questions about water use and water rights across the West.

We're thankful for all the funders, collaborators, and partners, which include philanthropic groups, federal government funding, the western states water agencies like the New Mexico Office of the State Engineer, the Internet of Water, CUAHSI, Don't Panic Labs (our IT contractor), and USGS. All of them have been wonderful in helping us. I'll leave you with this question for discussion if we have time. Would this water data for other western states be helpful to you in New Mexico? If yes, I would love to hear how, so we can better design the system to answer such questions for you. Thank you, Stacy.

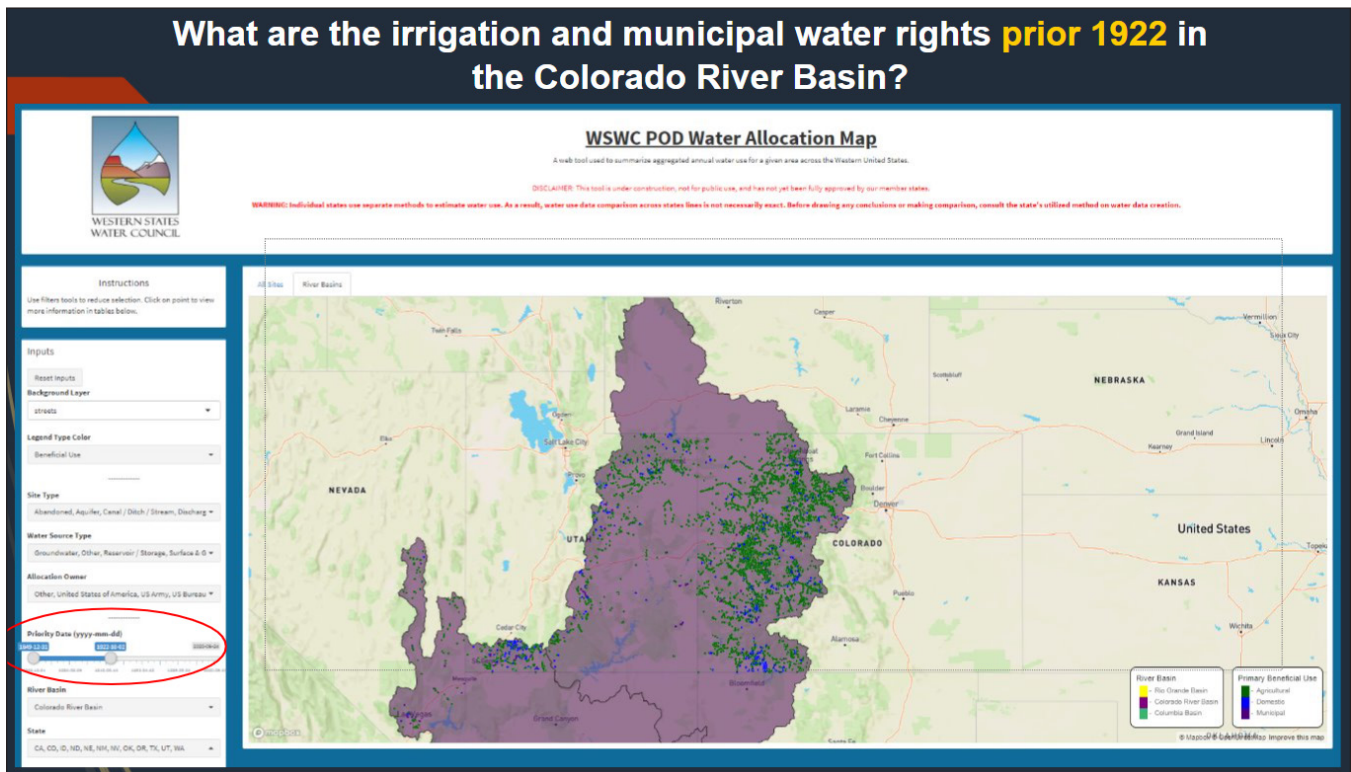


Figure 2. Irrigation and municipal water rights prior to 1922 example.

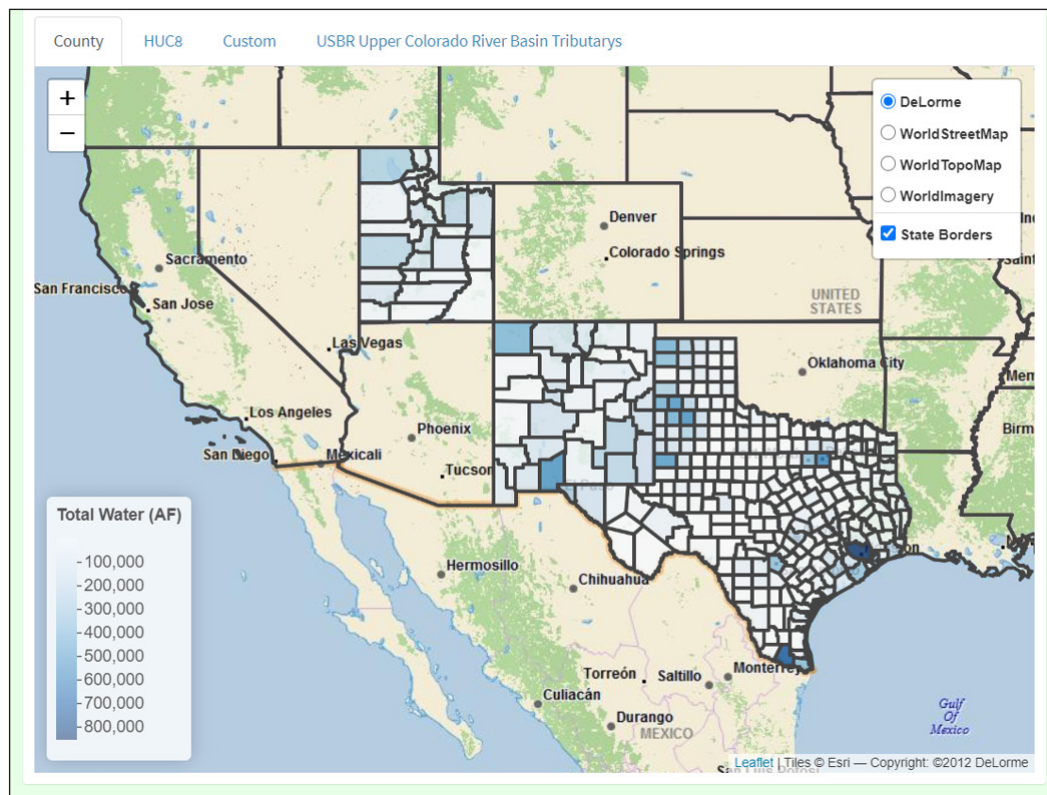


Figure 3. Aggregate county water use map.

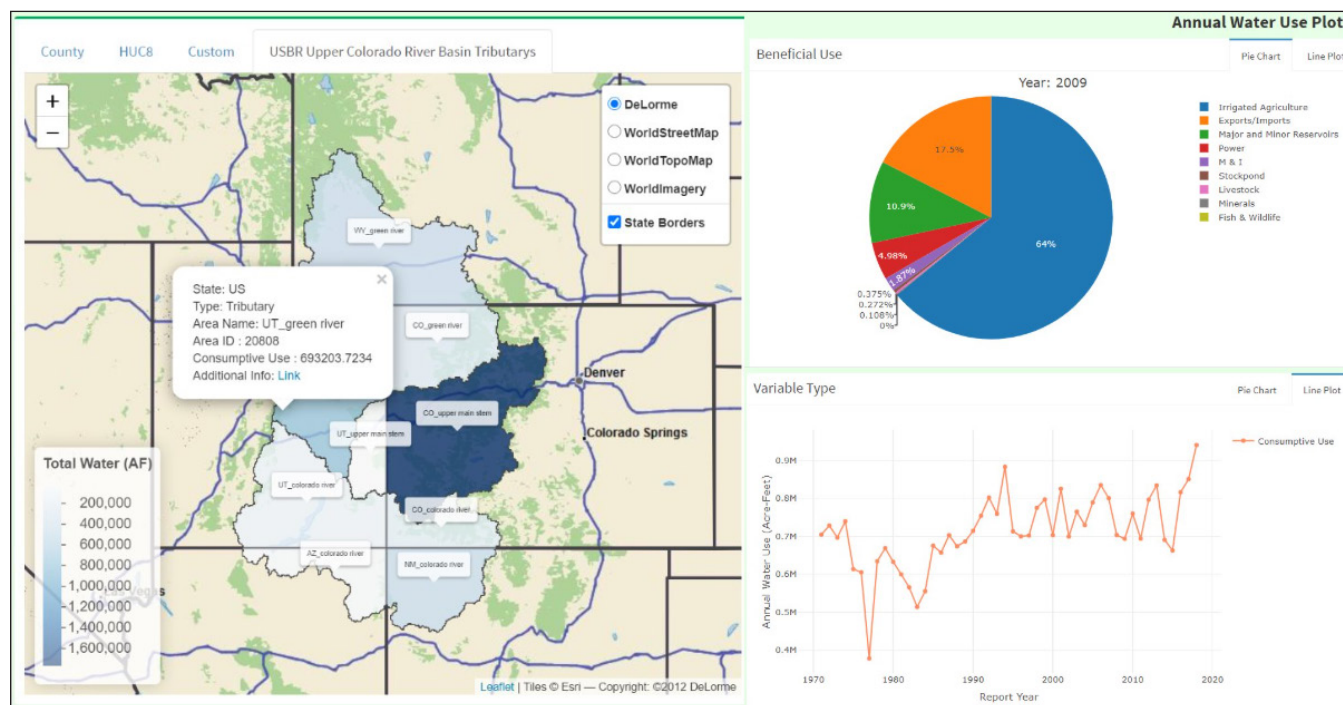


Figure 4. Aggregate county water uses map example.

Timmons: Thank you. I love the idea of having a little bit more feedback. Adel asked a great question, and I would also love to hear what kind of water data is exciting or interesting for you all. If you have any comments, please feel free to post them in the Q&A chat window. For right now, I wanted to quickly mention to Ashley that there are a lot of folks in this meeting who are working for state agencies, and I wanted to know if you had any comments or ideas on how they can engage in learning more about water data.

Ward: Thank you so much. I'm so glad you brought it up, Stacy; I should have raised this in my presentation. One of the efforts of the Internet of Water is the Peer-to-Peer (P2P) Network (<https://internetofwater.org/peer-to-peer-network/>). The P2P Network now has over 100 members from more than 30 states. The membership of the P2P Network is for state, local, and tribal government agency employees. It's also for utilities and river basin commission employees. The purpose of the P2P Network is to connect folks from all across the country who are working on different data-modernization efforts. They can share what they're doing, successes, and lessons learned. We host a forum where people can interact and ask questions, such as, "What do you do with all this legacy data?" We also host a webinar series. We have one workshop on metadata scheduled for November 17-18, 2020, in which Adel is one of the presenters. We've had a

lot of success with our webinars and have been very happy with the participation in those. If you have a good topic that you would like to see addressed, please let us know. We've talked about a water budgeting handbook. We've had an 'Ask the Data Architect' session, where people sent questions to our data architect, and he answered them during the webinar. Following the workshop on metadata, we will present some that highlight the work being done in other states. We would love to have you join us, and we hope you will.

Timmons: Thank you. Meredith, I would love to get your take on the various data that the West Big Data Innovation Hub works with and the community of folks you work with on these data challenges. Do you see water as being particularly challenging to work with relative to some other sectors of data that you're engaged with?

Lee: That's a great question, Stacy. I initially thought, given that wars have been fought over water and movies have been made about wars fought over water, that it would be pretty contentious. With the water rights that have been mentioned and the vulnerable community lens, we are shaping our first water data challenge and trying to gather all these voices and inputs. As we've regionally and nationally gone deeper in areas like health care, transportation, mobility, and access, all of these areas of social impact have lots of very complex issues around how to navigate the intersection of data, science, and people

responsibly and in a way that matches the pace—or lack thereof—of policy changes or legacy systems. It's not just the IT systems that are legacy and in need of rejuvenation. That was our initial take, that the water area would be more challenging compared to the others. There's a lot of difficulty all the way around, but the opportunity lies in trying to compare what has succeeded and is thriving in one particular area—resonating with Representative Melanie Stansbury's point—and how you can learn from that, even if it's in an area that's not water, or maybe it's not data, and translate that over to this realm.

Timmons: That's great. I love the idea of taking something that worked in a completely different sector and translating it to address the challenges we're working with.

There are a few comments asking about some of New Mexico's specific challenges that we're facing. I'll address that, and then perhaps we can talk briefly about some of the other states' perspectives. For New Mexico's challenges, I think we're seeing a lot of our state agencies have real struggles. I think it was alluded to in the panel just before but staffing availability and their budget restrictions or constraints make it very difficult for them to scale up, to build their skills to engage in this water data challenge. What we need to do is change the culture around how we handle data. Everybody has their way of doing it right now, and it's hard to envision something new and different when we're just busy keeping up with the day-to-day and trying to make ends meet with the time that we have available. The comment I would have to some of the biggest challenges here in New Mexico seems to come back to funding these agencies in order to support an engaged effort on this.

In looking at the chat, other questions I'm seeing are, "What are some of the most exciting and interesting water data efforts that are coming up across the country? Where are they succeeding, and what can we learn from others?" I don't know who wants to start that. Ashley, you're smiling.

Ward: One of the things I think is very interesting is the effort that we are undertaking. It's still ongoing, but we finished the first phase in California. Harmful algal blooms are a significant concern, and the California State Water Boards sought to develop a more robust reporting and notification system for these blooms. However, it is cost-prohibitive for the state to monitor water bodies throughout California. It's not something that the state can take on itself. So, we worked with the Internet of Water, with the California State Water Boards, a group of non-governmental organizations, and two tribal governments in California to develop a data-ingestion model so that nongovernment entities can easily ingest their monitoring data into the state system, expanding the state's capacity around monitoring and notification for harmful algal blooms. We've just finished this process where we put together the implementation plan, and now, at the

beginning of the year, we will work to implement what was laid out through that stakeholder-engagement process. What is important there is that when we talk about a time in which state capacity is limited, and probably going to grow more limited, this is one way in which we can get more data, how to address those issues about quality assurance and quality control, and how to expand state capacity for those types of questions, not just on harmful algal blooms. I can see that being used for a variety of other topics as well. I think that's something that's really exciting and may be of interest to the folks on this call.

Lee: There's another unique effort, a governance and consortium structure in California that I wanted people to be aware of called the California Water Data Consortium (<https://cawaterdata.org>). I could say I'm biased because I'm on the board of directors, but I'm an unpaid member. So, I feel confident in sharing that this is quite unique. The chief data officer and the head of the State Water Resources Control Board, and so many other key data stewards and leaders, are engaged in an official 501(c)(3). We announced a steering committee in November 2020, and that's something to stay tuned for, as it will provide lessons learned, best practices, and insights from friends on the other side of the border who are working to establish a sustainable partnership around data and data-enabled decision-making.

Timmons: I do have one question for Adel, and then I'll jump back over to the chat if we have time. Adel, I'm curious about the different states you've been able to engage with in the West, particularly in relation to part of WaDE's process. Speaking from my own perspective, the engagement with WaDE and being able to share data has been eye-opening for both the states and you. Can you discuss any comments you're hearing from some of your collaborating states and what they've learned through the process of engaging and sharing data with WaDE? Are there any thoughts that come to mind on that?

Abdallah: Thanks, Stacy. The general sense is that since we're trying to generalize how we share and represent data across state lines, we ask questions of our states about things like metadata or methods that normally they don't think about because the data is being used locally. There was no purpose to look at the data in the bigger picture, so I think it opened their eyes: "Oh, we should add these metadata columns in our data to better describe our own data." That has been the common theme that we have heard from our member states. Thinking in that way has been helpful to them. Data is usually collected for a single purpose, based on my personal experience and the findings from the Internet of Water. You can't collect data for all the purposes in the world. Sometimes, the metadata that is documented with the data is limited. However, when we start asking questions for a purpose other than the one for which the data was collected, states begin to think about

additional metadata or a different way to represent the data. I hope that helps.

Timmons: From our perspective, in working with New Mexico agencies, when we start saying, “Hey, but where’s the metadata? Where’s the instructions for how to use this?” people start saying, “Oh, okay, let me get back to you.” I think that’s a really important point regarding all our data practices: we have to remember to have some documentation about it.

Abdallah: And that costs time and money. That can be annoying too, say, if I want to finish this data collection, share the data, and then move on, but I have to go back and try to add that metadata. It’s a process, but I think in the long term, the more we add that metadata, the more value we can get out of that data with minimal additional expense.

Timmons: Right. And making that part of the common practice of how we manage our data now, and going forward, and not just shoving it out in an Excel file and saying, “There we go. Deal with it.”

Abdallah: Exactly, and it takes some training. I’m glad to see all those folks on the call today, because it takes some training sometimes to get the bigger picture of what we want to do with this data. There’s an insight gained from working with others.

Timmons: Are there any other burning comments? I’m seeing the time limit. Do you want to make any last remarks on water data or water data in New Mexico at this point before we end this session?

Ward: Stacy, Lily Conrad brought up a good point about how we’re connecting with communities that have less capacity to engage in this way, and I think it’s a great point. Meredith, I see you’ve put a link to some information. I would also like to add a couple of comments to directly address Lily’s comment. There are many components of this question. One way the Internet of Water is addressing these issues is by creating all our tools as open source. Most of the information is available. There are no proprietary software packages, and therefore, there is no cost associated with them. Many of the tools, such as the Geoconnex tool we’re developing, are designed to enable people with limited technical expertise to access the data. How does this impact different communities? We’re more in the background, less upfront. We play a more indirect role in the sense that we work with organizations that work in these communities. We are not only enabling these organizations to have access to data but also thinking about how that data is delivered with regard to dashboards,

making sure that it’s communicated in a way that is clear and understandable, and supporting these organizations who work regularly within communities so that they can then deliver information and support the community with this data and information that they have. That’s how the Internet of Water has been engaging with different communities that find themselves perhaps on the outside, without the capability to engage otherwise.

Timmons: Meredith, is there a link you’d like to share with the broader community?

Lee: Yes, I have some links that I would love to share. Lily’s question pointed to efforts to help connect communities that may not have internet access—broadband, let alone any internet—and how to, importantly, address inherent disparities in privilege or access. One link I added was to some video recordings from early June (https://www.waterboards.ca.gov/resources/data_databases/wq_science_symposium.html). Day one of the California State Water Boards’ Water Data Science Symposium had some great panelist discussion, if you look up the environmental justice community discussion on some of these issues.

I see many parallels with the disaster response and recovery community. There’s a great five-minute lightning talk that I can share at another time from a colleague on the FEMA National Advisory Council, Dr. Nicolette Louissaint, who is thinking about existing infrastructure and what it would look like to ease the burden. Making people aware that not everyone can simply hop on a Zoom is definitely something that I think deserves greater emphasis and advocacy, along with how we can mitigate the inherent systemic inequities in the shift that we’re all experiencing right now.

Timmons: I would like to add that we’re currently working on outreach efforts through the New Mexico Water Data Act to engage with communities across the state, not just via Zoom. It’ll be printed material for a little while until we can feel safe going out and meeting in person. I would welcome ideas about how we can connect with some of these various communities. In our more rural parts of the state, we would love to hear from them about how and what type of water data they would like to find.

I just want to quickly say a huge thank you to Ashley, Meredith, and Adel. This panel has been totally awesome considering all our time commitments around this, and I appreciate all of your support for our work here in New Mexico on water data. Thanks, everybody.