



**Western States Water Council
and
U.S. Geological Survey**

SOCIAL HOUR

**September 17, 2019
Fort Collins, Colorado**

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2019 WSWC Water Information Management Systems (WIMS) Workshop/USGS National Water Use Data Collaboration

September 16-19, 2019 | Fort Collins, Colorado

Workshop Goals: This Water Information Management Systems (WIMS) and USGS National Water Use Data Collaboration workshop serves as a forum for states and other attendees to exchange information on water use data science, state agency strategies for getting to high quality water use information, including online reporting automated data checking, and remote-sensing and IT solutions for sharing water data with federal agencies and the public.

Monday, September 16

12:30pm	WIMS Workshop Registration – <i>Fort Collins Science Center, Building C, Meeting Room 2000</i>
1:00pm	Welcoming Remarks – <i>Overview of Water Information Management Systems and the Importance of Data and Data Publication for Western Water Sustainability</i> Tony Willardson, Executive Director, Western States Water Council <i>Importance of Water Use Data for U.S. Geological Survey WMA Programs</i> Molly Maupin, Hydrologist, National Water Use Science Project Lead, US Geological Survey <i>Water Data Exchange Program (WaDE): New Architecture</i> Adel Abdallah, WaDE Program Manager, Western States Water Council
2:15pm	Bureau of Reclamation and NASA Western Water Applications Office Efforts - Moderator, Adel Abdallah <i>Consumptive Use and Loss Reporting and Recent Estimation Studies in the Upper Colorado River Basin</i> Jim Prairie, Hydraulic Engineer U.S. Bureau of Reclamation <i>National Aeronautics and Space Administration (NASA) / Western Water Applications Office</i> Forrest Melton, Program Scientist, NASA Western Water Applications Office <i>Questions/Discussion</i>
3:05 pm	<i>Refreshment Break</i>
3:30pm	Regional Water Use Data Efforts - Moderator, Savannah Cooley <i>New Mexico Water Use and Data</i> Molly Magnuson, Water Use and Conservation Bureau Chief, New Mexico Office of the State Engineer <i>Utility Customer Data Privacy and Aggregation Best Practices</i> Ben Ruddell, Northern Arizona University <i>OpenET: Filling a Critical Data Gap in Western Water Management</i> Forrest Melton, Senior Research Scientist, NASA Ames Research Center, Cooperative for Research in Earth Science and Technology (ARC-CREST)
4:45 pm	Wrap Up and Adjourn

Tuesday, September 17

8:30 am Recap Prior Day and Refreshments

9:00-am Western States Water Use Data Efforts – Moderator, Savannah Cooley

Data Science and Enterprise Data Management at the Arizona Department of Water Resources

Lisa Williams, Manager, Office of Data Management, Arizona Department of Water Resources

Data Engagement and Integration Activities at a State Agency

Greg Gearheart, Deputy Director, Information Management and Analysis, California State Water Boards

Planning for Utah's Water Future

Candice Hasenyager, Assistant Director, Utah Division of Water Resources

Questions/Discussion

10:15 am Refreshment Break

10:45 am Western States Water Use Data Efforts - Moderator, David Ketchum

Statewide Water Supply Planning and the Colorado Water Plan

Russ Sands, Senior Program Manager, Colorado Water Conservation Board

The Texas Water Development Board's Texas Water Service Boundary Viewer

Bill Billingsley, Manager, Water Use & Planning Data, Texas Water Development Board

Nevada's Water Use Estimates and Data Sharing Efforts

Adam Sullivan, Deputy State Engineer, Nevada Division of Water Resources

12:00 pm Lunch (On Your Own)

1:30 pm Western States Water Use Data Efforts – Moderator, Bill Billingsley

Texas Reservoir Evaporation: Upgrading the Monitoring Network

Andrew Weinberg, Geoscientist, Texas Water Development Board

Water Use Data in Wyoming: What Does the Future Hold?

Jodee Pring, Supervisor, River Basin Planning, Wyoming Water Development Office

Wyoming's Water Use Data Collection and Management

Charlie Ferrantelli, River Basin Coordinator, Wyoming State Engineer's Office

Questions/Discussion

2:45 pm Refreshment Break

3:15 pm Western States Water Use Data Efforts – Moderator, Andrew Weinberg

Estimating Irrigation Efficiency in Montana Using Remote Sensing Tools

David Ketchum, Hydrologist, Montana Department of Natural Resources and Conservation

Kansas Water Use Reporting and Data Management

Ginger Pugh, Professional Civil Engineer, Kansas Department of Agriculture

The Internet of Water and Regional Water Use Estimation and Reporting

Kyle Onda, Data Architect, Internet of Water

4:30 pm Wrap Up and Adjourn

5:30 pm Social Hour (Hors d'oeuvres) at the Fort Collins Hilton Hotel sponsored by 

Wednesday, September 18

8:30 am Recap Prior Day and Refreshments

9:00 am National Water Use Data Efforts – Moderator, Molly Maupin

USGS Water-Use Data and Research Program (WUDR) Overview

Kim Shaffer, Water Use Data and Research (WUDR) Coordinator

USGS Water Use Data System Modernization and WaDE Collaboration

Nancy Barber, Hydrologist

USGS Water Use, the Internet of Water, and the National Hydrography Infrastructure

Dave Blodgett, United States Geological Survey (USGS)

Questions/Discussion

10:15 am Refreshment Break

10:45 am Regional/University Water Use Data Efforts – Moderator, Dave Blodgett

Water Using Remotely Sensed Data and Gridded Weather Datasets to Estimate Evapotranspiration for Water Use Mapping and Water Budget Studies in Diverse Ecosystems

Gabriel Senay, Research Physical Scientist

Mapping and Modeling of Interbasin Water Transfers Within the United States

Landon Marston, Assistant Professor, Kansas State University

Nebraska Water Use Data

Jesse Bradley, Assistant Director, Nebraska Department of Natural Resources

12:00 pm Lunch (On Your Own)

1:30 pm State Water Use Data Efforts – Moderator, Nancy Barber

Pennsylvania's Water Use and Data Research (WUDR) Projects

Michael Hill, Geologist, Pennsylvania Department of Environmental Protection

Consolidating Water Use Data in North Carolina

Linwood Peele, Water Supply Planning Branch Supervisor, NC Division of Water Resources

Utilization of WUDR Funds in North Dakota: Municipal Water, Per Capita Coefficients, and the Bakken Region

Jack Norland, Assistant Professor, North Dakota State University

Questions/Discussion

2:45 pm Refreshment Break

3:15 pm State Water Use Data Efforts – Moderator, Tamara Ivahnenko

DocStar, Document Management, Arkansas's Answer to Water Use Reporting

Amy Chatwood, Computer Support Coordinator, Arkansas Natural Resources Commission

Water Use Reporting in Missouri

Scott Kaden, Groundwater Section Chief, Missouri Geological Survey-Water Resource Center

Improving Illinois' Water Data Acquisition and Analyses

Vlad Iordache, Water Resources Application Developer, Illinois State Water Survey

4:30 pm Summary of the Day, Action Items, and Adjourn

Thursday, September 19

8:30 am Recap Prior Day and Refreshments

9:00 am **Breakout Sessions** – 3 Groups, Answer 5 Questions, 15 minutes each

1. What are the challenges in getting the data you need to meet your regulatory, water planning and other obligations? Do you have adequate information/data on surface/groundwater uses? If not, do you have plans for a solution to those challenges? What data are missing now?
2. What water use reporting (2020 and beyond) for regulatory and institutional purposes are most important to your State? What data standards for QA/QC, accuracy, and completeness do you use in the State to monitor water supply or use?
3. What are your State's water use reporting systems and gaps in technical support, and methods? What future updates/plans for data collaboration, models, data services do you have? If water use data are reported voluntarily by water users, does your agency provide guidelines for reporting?
4. What is an acceptable lag time given reporting schedules? Monthly time-step? What are acceptable, optimal, spatial resolutions for State assessments of supply and use information (site-specific, HUC-8, custom spatial units)? What are the challenges in working in a common spatial unit (HUC 8, 10, 12)?
5. What can WaDE or WUDR do to help your state meet its challenges?
6. Would you like to share lessons learned with other states?

10:30 am Discussion Break and Refreshments

11:00 am Breakout Session Reporting - 4 or 5 groups with about 5-10 min each

12:00 pm Discussion and Next Steps - Feedback for Next WIMS

12:30 pm Adjourn

2019 WSWC Water Information Management Systems (WIMS) Workshop / USGS National Water Use Data Collaboration

**Fort Collins USGS Science Center
2150 Centre Avenue, Building E
Fort Collins, CO 80526**

September 16-19, 2019

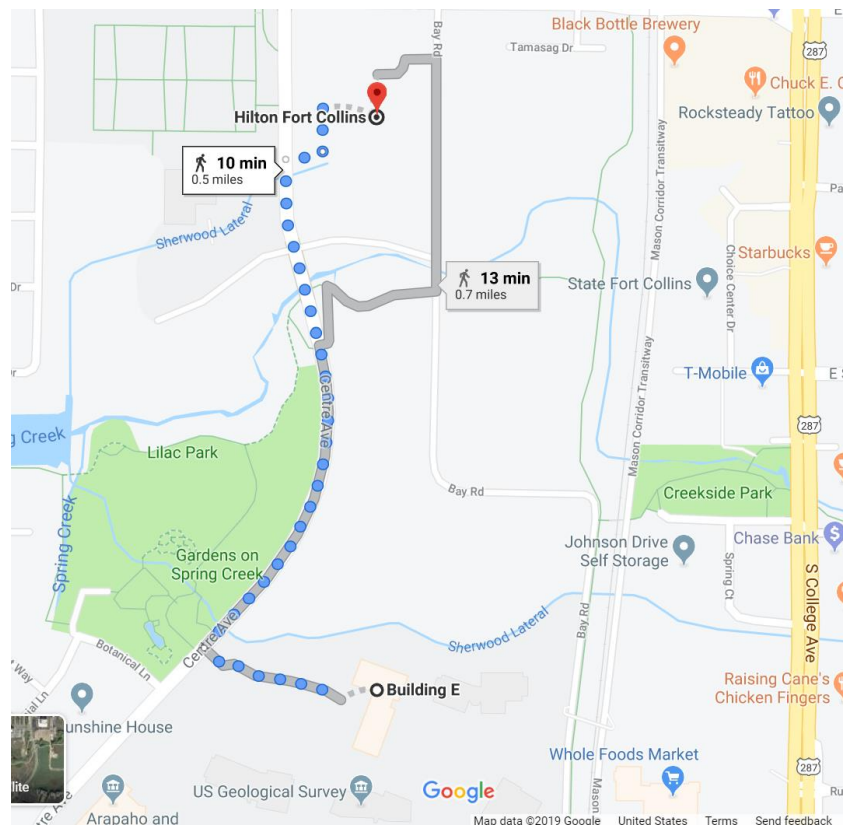
THE MEETING LOCATION IS A SECURE FACILITY SO BE SURE TO BRING YOUR GOVERNMENT ID, DRIVER'S LICENSE, OR EQUIVALENT EACH DAY TO SIGN IN.

PARKING/TRANSPORTATION:

Parking at the USGS Center is limited. If you can, please carpool, walk, check out a bike, or ride a bus.

1. Walking directions from the Center to the Hilton Hotel

Hilton Fort Collins, 425 W Prospect Rd, Fort Collins, CO 80526



2. Bike: Download the free Pace bike sharing app from the App Store or Google Play "Pace As You Go: \$1 per 15 minutes"

3. **Bus:** Take a bus from the Center & Bay station (nearby Hilton Fort Collins) to the Centre & Botanical station (near by USGS Center) \$1.25 per single ride (exact fare only)

SCIENCE CENTER INTERNET LOG-IN:

Username: guest-6839502

Password: sddp8221

NEARBY RESTURANTS:

Maza Kabob

2427 S College Avenue
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(970) 484-6292

Totally 80's Pizza

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120 W Stuart Street, Unit A
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The Colorado Room

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Cafe De' Bangkok

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Music City Hot Chicken

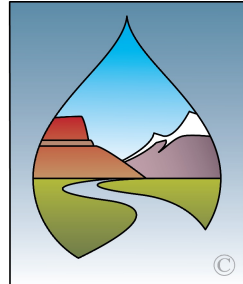
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Bawarchi Biryani Point

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The Rainbow Restaurant

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WESTERN STATES
WATER COUNCIL



Water Information Management Systems Workshop

Fort Collins Science Center

Fort Collins, Colorado

September 16-18, 2019

PRESENTER BIOGRAPHIES



ADEL ABDALLAH is the Program Manager of the Water Data Exchange (WaDE) program at the Western States Water Council (WSWC). Dr. Abdallah has worked for the Council for 2 years. He received his Ph.D. from the Utah State University in the Summer 2019 in Civil and Environmental Engineering with emphasis on Hydroinformatics. His expertise is in designing data models to reconcile semantic and syntactic water management data differences to streamline their access and analysis.



NANCY BARBER is a Hydrologist with the U.S. Geological Survey (USGS) South Atlantic Water Science Center in Norcross, Georgia. She has a BS in Geology from the Emory University, an MBA from Georgia State University, and did graduate coursework in groundwater hydrology at the University of Texas at Austin. Nancy began her career with the Georgia Geologic Survey and was quickly assigned to work on the water-use program in cooperation with the USGS. During graduate school she jumped to USGS, first to work on the 1985 national water-use compilation for Texas, then to groundwater and water-use projects in Jackson, Mississippi, and eventually transferring back to her home state of Georgia in 1994. Since 2000, she has been a member of the National Water-Use Leadership Team, with a role focused on data and database management. She also serves as the Data Steward for the Water Availability and Use Science Program.



BILL BILLINGSLEY is the Manager of the Water Use and Planning Data department at the Texas Water Development Board. He oversees the agency's water use survey program, regional and state water planning data sets, administration of the Texas Water Service Boundary Viewer, and the associated computer applications and databases. These data sets are specifically used in the regional and state water planning process and to aid in water planning. Bill has more than 25 years of combined public service experience working in public health, water resources, and data analytics for three Texas agencies. He holds a BS in Biology and a Master of Public Administration from Texas State University.



DAVE BLODGETT is a Hydro-informatics Specialist with the U.S. Geological Survey (USGS) Integrated Modeling and Prediction Division Geo-Intelligence Branch. He has an M.S. in water resources engineering from the UW-Madison. He is currently working as a hydro-informatics lead across the USGS Water Mission Area and the hydrosience community.



JESSE BRADLEY is the Nebraska Department of Natural Resources Assistant Director. Jesse has worked for the Department for over thirteen years. In his current role as Assistant Director, Jesse provides oversight and support to many of the Department's programs, including the Permits and Registrations Division, the Engineering and Technical Services Division, Water Administration, and the Water Planning Division. Jesse has extensive experience in water planning and hydrologic assessments across Nebraska and has participated extensively in the development and implementation of integrated management plans and basin water planning activities throughout the state. Jesse earned a BS in Environmental Geology from the University of Nebraska Omaha and an MS in Hydrogeology from Clemson University. Jesse also is a licensed professional geologist in the state of Nebraska.



AMY CHATWOOD is the IT and Computer Support Division Coordinator at the Arkansas Natural Resource Commission (ANRC), an agency that oversees flood management, water supply development, and conservation of the State's land and water resources. She has been actively employed in IT related fields for 30 years. Amy earned a Bachelor of Science in Computer Information Systems with a minor in Management from the University of West Florida in Pensacola. She has been instrumental in setting ARNC up on DocStar and transferring digital and paper files into the system. She serves on the Transformation Action Committee which is handling ARNC's transformation from an independent agency to a division under the Arkansas Department of Agriculture. Amy resides in a small town on the outskirts of Little Rock, Arkansas.



CHARLIE FERRANTELLI has been working with the Wyoming State Engineer's Office since 2014. He currently serves as one of two Colorado River Coordinators for the Interstate Streams Division in which he acts as a representative to numerous interstate bodies responsible for Compact and Decree compliance. He participates in water management roles in various river basins, including the Colorado River Salinity Control Program Work Group, the Glen Canyon Dam Adaptive Management Program, and the North Platte Decree Consumptive Use Subcommittee. He is also responsible for calculating Wyoming's consumptive use in the Colorado River basin, which includes operating and maintaining multiple agricultural climate stations across the state. He received an M.S. in Hydrogeology/Geology in 2007, from Colorado State University, and a B.A. in Geology in 2001 from the University of Northern Colorado.



GREG GEARHEART, PE, is a Deputy Director at the California State Water Resources Control Board and considers his job to be the chief data liberator for all the Water Boards' data. He has been the director of the Office of Information Management and Analysis for four years. Prior to this appointment Greg served as the statewide Storm Water Program Manager for about seven years. In his 25 years at this organization Greg has worked in many different program areas, including wetlands, watershed management, organizational development and enforcement. Greg received a BS in Environmental Resources Engineering from Humboldt State University and also grew up behind the redwood curtain.



CANDICE HASENYAGER is the Assistant Director of the Planning Branch at the Utah Division of Water Resources. She oversees statewide water planning efforts, hydrology, modeling and the technical needs of Water Resources. Candice has worked on water resource and planning projects for the last 12 years. In addition to managing, she has been involved in surface water modeling, hydrology studies, and municipal water demand projections. For the last year, she has been involved in the Water Banking efforts of the State. She has met with stakeholders, attended the large group water banking meetings, and has been an active member of the pilot subgroup. She went to the University of Utah where she graduated with a Bachelor of Science and Master of Science in Civil Engineering.



MICHAEL HILL is a licensed Geologist with the Pennsylvania Department of Environmental Protection. Michael has been working with Pennsylvania's Water Use Data Program since 2005, where he has specialized in using GIS and data management.



VLAD IORDACHE is a Water Resources Application Developer for the Illinois State Water Survey (ISWS). He has been with the University of Illinois at Urbana-Champaign for the past 10 years, first as an undergraduate and graduate student in the Geology Department, then as an employee of the Illinois Water Inventory Program (IWIP) collecting annual water use data from high capacity water users throughout the state. His current work includes consulting with groundwater hydrogeologists, IWIP staff, and floodplain engineers to develop custom software and web-based applications to modernize and automate data collection/processing, modeling efforts, and presentation of results to the public.



SCOTT KADEN has been with the Missouri Geological Survey for 21 years. During his tenure he has spent time regulating the construction of wells (water, monitoring, heat pump, geologic test), developing a source water assessment plan for public drinking water supply systems, conducting hydrologic evaluations of potential liquid waste treatment facilities and landfill sites, assessing Missouri's mineral fuels, overseeing the permitting of oil, natural gas and underground injection wells, and managing the Groundwater Section which is responsible for maintaining Missouri's groundwater level observation well network, conducting field investigations to determine water quality and flow of springs, assisting with the technical issues related to the construction of public water supply wells, and the collection of water use data from Missouri's major water users.



DAVID KETCHUM is a Surface Water Hydrologist for the Montana Department of Natural Resources and Conservation (DNRC), a position he has held since 2017. David's background is in soil water balance modeling, though in his position at DNRC, he has focused on bringing modern remote sensing tools to bear on Montana water investigations. David's first project at DNRC was a Water Use Data and Research project, where he worked with the Wyoming-Montana Water Center and USGS Scientists from EROS to estimate irrigation efficiency and total water withdrawals in Montana using ground- and remote sensing-based data. David is also currently working on his PhD at University of Montana, where he is using machine learning methods to automate irrigated lands detection.



MOLLY MAGNUSON is the Water Use and Conservation Bureau Chief for the New Mexico Office of the State Engineer in Santa Fe, New Mexico. Major tasks include the quantification of irrigation water requirements for adjudications and litigation efforts, water conservation efforts, and drought-related planning/monitoring. She has been the bureau chief since 2015 and has worked in that bureau since 2006. Prior to that, she worked for the NM Interstate Stream Commission in the Colorado River Bureau. She is a registered Professional Engineer in New Mexico and has degrees in Agricultural Engineering from Oklahoma State University and New Mexico State University.



LANDON MARSTON is an Assistant Professor in the Civil Engineering Department at Kansas State University. He earned his bachelor's degree in civil engineering and MBA from the University of Kentucky, master's degree in civil engineering from Texas A&M University, and doctorate in civil and environmental engineering from the University of Illinois at Urbana-Champaign. Before pursuing his doctorate, he worked for the U.S. Army Corps of Engineers as a hydrologic and hydraulic engineer. Dr. Marston's research aims to provide new understanding and solutions for sustainable water resources management through data synthesis, modeling, and analysis of integrated socio-hydrologic systems, which stretch across multiple spatial and temporal scales.



MOLLY MAUPIN is the U.S. Geological Survey (USGS) National Water Use Science Project team lead, located in Boise, Idaho, with the Idaho Water Science Center. She has been with the USGS for over 34 years and has always been involved in water use at some level, either within the State of Idaho, or regionally in the West, or on National Programs. She began her career as a student while attending Boise State University, and after graduating in 1986, was hired full time and began working on the 5-year compilations along with multiple other projects, including the Snake River Plain RASA, the Nation Water Quality Assessment Program (NAWQA) for the Upper Snake River Basin, and or projects with the State of Idaho mapping depth to groundwater in the Snake River Plain and tributaries. In 2000, Molly joined the National Water Use team as Western Region Water Use Specialist, and in 2013, took the lead position for the team.



FORREST MELTON is a Senior Research Scientist with the NASA Ames Cooperative for Research in Earth Science and Technology (ARC-CREST) and with California State University, Monterey Bay. Forrest currently serves as the Program Scientist for the NASA Western Water Applications Office, and as an Associate Program Manager for Water Resources with the NASA Applied Sciences Program. Since 2003, he has worked in the Biospheric Sciences Branch at NASA Ames Research Center on the development of modeling and data assimilation frameworks including the Satellite Irrigation Management Support (SIMS) system, the Terrestrial Observation and Prediction System (TOPS) and the NASA Earth Exchange (NEX). His research interests include applications of satellite data to improve management of natural resources, remote sensing of evapotranspiration and agricultural water requirements, and ecosystem and carbon cycle modeling. Forrest holds B.S. and M.S. degrees in Earth Systems Science from Stanford University, and has authored over forty papers and book chapters on applications of remote sensing. He is the recipient of honor awards from NASA for his contributions to TOPS and NEX, and has been recognized for his work on applications of satellite data for water management with awards from the California Department of Water Resources, the Federal Labs Consortium and NASA.



JACK NORLAND is an Associate Professor of Natural Resources in the School of Natural Resource Sciences at North Dakota State University. He earned a B.S. at Iowa State University and a M.S. at Montana State University. His PhD degree was in Natural Resource Management at North Dakota State University. Prior to joining the faculty at NDSU in 2008 he worked as a research biologist in Yellowstone National Park and as a research specialist at NDSU. Dr. Norland interests are varied. He has worked on issues ranging from understanding the effects of wildfire on forests, grasslands, and wild ungulates, to remote sensing of various ecosystem variables in different landscapes. His interest in water quality/quantity issues ranges from assessing wetlands to developing more benefits from storm water detention basins and determining water use patterns in North Dakota. His teaching efforts include teaching a course on watershed management in rangeland systems and a course on GIS for natural resource management with many examples directly related to water management.



KYLE ONDA the Data Architect at the Internet of Water project. The Internet of Water aims to facilitate the discoverability, accessibility, and usability of water data by promoting the use of metadata and data standards, creating resources to allow for the online publication of public water data, and demonstrating the value of open water data through demand-driven pilot projects. Kyle is a trained environmental engineer, urban planner, environmental public health professional, and social scientist. He has broad experience as a water data producer, manager, and user in a variety of roles in regulatory agencies, academia, and the private sector.



LINWOOD PEELE is the Engineering Supervisor for the Water Supply Planning Program in the Division of Water Resources within the North Carolina Department of Environmental Quality. During his nearly 24-year tenure, he provides technical and administrative oversight to ensure compliance with the 13 state-wide programs within the Water Supply Planning Branch. Of the 13 programs, the ones related to water use data is as follows: Water Supply Planning, Water Supply Assistance and Development, Water Withdrawal & Transfer Registration, Interbasin Transfer Certification & Drought Monitoring and Management. Linwood serves as the State Agency Liaison on the NC Rural Water Association's Legislative and Regulatory Committee, where he assist with the regulatory matters affecting NCRWA and their constituents. Linwood also serves on the NC America Water Works Association's Water Resources and Regulatory Affairs Committee, where he assist the committee in establishing workshops, seminars and agendas that focus on water resources related topics as well as new regulations that effect water systems throughout North Carolina. Linwood holds a Master of Science degree in Civil Engineering (with a water resources concentration) and a Bachelor of Science degree in Civil Engineering.



JIM PRAIRIE, Ph.D. is a Hydrologic Engineer working for the Bureau of Reclamation since 2000. He is stationed at the University of Colorado's Center for Advanced Decision Support for Water and Environmental Systems (CADSWES). Dr. Prairie has extensive experience directing and coordinating research, development, and modeling projects. He leads applied research in mid-term operations and long-term water resource planning, climate variability, and decision support under uncertainty. He directs river basin modeling technical teams; and oversees the consumptive use, natural flow and natural salinity development programs for the upper Colorado River basin. Dr. Prairie received his Ph.D in Civil Engineering for the University of Colorado, Boulder and a B.S in Environmental Resource Engineering from the State University of New York College of Environmental Science and Forestry.



JODEE PRING works at the Wyoming Water Development Office and is the River Basin Planning Supervisor. She started her state career in November of 1988 with the Wyoming State Engineer's Office. She has been involved in River Basin Planning for the state of Wyoming for over 15 years. Jodee is a Certified Mediator, receiving her training through the State of Wyoming, Agriculture and Natural Resource Mediation Board. She is also involved in many professional organizations including the Interstate Council on Water Policy (ICWP) and the Wyoming Water Association (WWA), serving as vice-president of that organization. Jodee lives in Cheyenne with her husband Mark and their dogs, Loki and Ullr. When not working, Jodee likes to mountain bike, hike, ski and scuba dive.



GINGER PUGH is the Kansas Department of Agriculture, Division of Water Resources, Water Management Technical Services section head. Professional Engineer - Biological and Agricultural Engineering. BS Biosystems Engineering, MS Biological and Agricultural Engineering, Kansas State University. Manhattan, Kansas.



BEN RUDELL, Ph.D, P.E., is the Director and Associate Professor of the School of Informatics, Computing, and Cyber Systems at Northern Arizona University, the President of Ruddell Environmental consulting, and the Director of the FEWSION project. His PhD is in Civil and Environmental Engineering from the University of Illinois at Urbana-Champaign. His professional experiences are in the fields of civil engineering, water resources, systems analysis, ecology/ecohydrology, and engineering research and education in an interdisciplinary university setting.



RUSS SANDS has worked in the water industry for more than 13 years. His career has included time spent in water quality at Denver Water, managing water conservation and stormwater programs for the City of Boulder, and working as a consultant on climate, resilience and water challenges. As Senior Program Manager for the Colorado Water Conservation Board, Russ works across the state with stakeholders on local and regional water challenges. Russ is currently working on statewide basin planning after the release of the Analysis and Technical Update to the Colorado Water Plan which uses technical analysis to evaluate current and future water availability and will ultimately help inform the update to the Colorado Water Plan itself.



GABRIEL SENAY is a Research Physical Scientist with USGS Earth Resources Observation Science (EROS) Center, co-located within the North Central Climate Adaptation Science Center, Fort Collins, Colorado. His research focuses on the use of remote sensing data for agro-hydrologic applications with a focus on crop water use mapping, basin water budget studies and drought monitoring.



KIM SHAFFER has a degree in Civil Engineering from the Ohio State University and has worked for the U.S. Geological Survey for the past 22 years. As a hydrologist, she has collected and published streamflow, water-quality, and water-use data. Kimberly has published over 9 reports and fact sheets. She is the USGS Water-Use Data and Research Program coordinator, the USGS Ohio water-use specialist, and the Ohio water-quality monitor project leader.



ADAM SULLIVAN is the Deputy State Engineer at the Nevada Division of Water Resources where he is actively engaged in many of the most complex water problems facing Nevada today. He oversees the hydrology and engineering sections, and the Division's Las Vegas branch office. Adam has been with DWR since 2009, and previously served as the hydrology section chief. Prior to his work with DWR, Adam worked at various civil engineering firms in northern Nevada where he specialized in water resource projects. Adam is an alumnus of the UNR graduate program of hydrologic sciences, and a licensed professional engineer. He was a board member of the Nevada Water Resources Association from 2013-2019.



BRANDON TOMCHUK, from DocStar, lives in North Texas, and has 17 years of experience consulting with organizations to assist them in document automation and storage solutions.



ANDREW WEINBERG has worked at the Texas Water Development Board (TWDB) since 2009 researching groundwater recharge, lake evaporation, and other surface-water groundwater interactions. Before coming to the TWDB he worked in the environmental consulting sector for 20 years doing site investigation/remediation and water resource assessment projects.



TONY WILLARDSON was named as Executive Director of the Western States Water Council in July 2009. The Council has served the western states since 1965, when it was created by the western governors. The Council represents 18 states, and members are appointed by their respective governors. Tony joined the Council in 1979. He holds a BA in political science from Brigham Young University, with minors in economics and business management, and a MS in public administration from the University of Utah. He is a member of the National Honor Society for Public Affairs and Administration (Pi Alpha Alpha). He oversees the publication of a weekly newsletter, Western States Water, and is the author of numerous articles, reports and policy positions covering a wide range of water resource issues, including water related data gathering and monitoring, remote sensing of water use, water conservation, drought, water use fees, water project financing and cost sharing, ground water management and recharge, interregional water transfers, intrastate water transfers, and future water needs and sustainable water supply strategies. He has been called upon often to present western states views related to federal policies, guidance, rules and legislation, testifying before Congress on numerous occasions. He oversees the Council's Water Data Exchange (WaDE) Program, which enables states to share data with each other, decisionmakers and the public in a more streamlined and cost-effective way.



LISA WILLIAMS is the Manager of the Office of Data Management at the Arizona Department of Water Resources (ADWR). ADWR is the steward of Arizona's water future and ensures long-term, reliable water supplies to support the continued economic prosperity of the State. For her first twenty-seven years at the agency, she administered Arizona's 1980 Groundwater Management Act and as such assisted the regulated community in understanding, and complying with, the requirements of that statute. She was also responsible for implementing new statutory requirements, and for overseeing the collection and compilation of demand and supply numbers for the areas required to report water use. The efficient and accurate collection, storage and use of data has always been her first passion, however, so she recently officially moved to data management full-time when her agency began the process of implementing enterprise data management.

Water Information Management Systems Workshop



Sponsored by:
Western States Water Council
and
U.S. Geological Survey



September 16-19, 2019
Fort Collins, Colorado

Attendees List

Dr. Adel Abdallah

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Scott Cuthbertson

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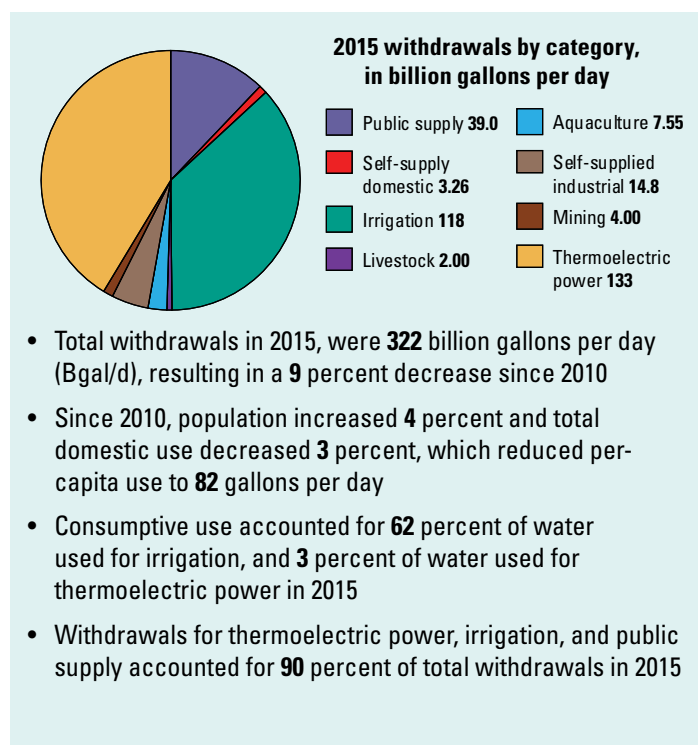
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Summary of Estimated Water Use in the United States in 2015



A total of **322** Bgal/d of water withdrawals was reported for eight categories of use in the United States in 2015, which was 9 percent less than in 2010 (**354** Bgal/d), and continued a declining trend since 2005. The decline in total withdrawals in 2015 primarily was caused by significant decreases (**28.8** Bgal/d) in thermoelectric power, which accounted for **89** percent of the decrease in total withdrawals. Between 2010 and 2015, withdrawals decreased in all categories except irrigation (**2** percent increase), mining (**1** percent increase), and livestock (**no change**). Fresh surface-water withdrawals (**198** Bgal/d) were **14** percent less than in 2010, and fresh groundwater withdrawals (**82.3** Bgal/d) were about **8** percent more than in 2010. Saline surface-water withdrawals (**38.6** Bgal/d) were **14** percent less than in 2010, and saline groundwater withdrawals (**2.34** Bgal/d) were 5 percent more than in 2010. Total population in the United States in 2015 (**325** million) increased by **4** percent (**12.4** million) from 2010, which was similar to the increase between 2005 and 2010. For the first time since 1995, consumptive use for irrigation and thermoelectric power were reported. Consumptive use accounted for **62** percent (**73.2** Bgal/d) of water used for irrigation, and **3** percent (**4.31** Bgal/d) of water used for thermoelectric power in 2015.

Water Use by Category

Withdrawals for thermoelectric power, irrigation and public supply accounted for 90 percent of total withdrawals in the United States. Withdrawals by category and State, arranged from west to east (fig. 1) indicate the general geographical pattern of water use across the country. Thermoelectric-power withdrawals were prominent in the east and irrigation withdrawals were prominent in the west. Public-supply withdrawals are greatest in the states with the largest population centers.

Withdrawals for **public supply** were about 12 percent (39.0 Bgal/d) of total withdrawals, and 61 percent of public-supply withdrawals were from surface-water sources. Public-supply systems deliver water to domestic, industrial, commercial, and other users, and 60 percent of public-supply withdrawals provided 87 percent of the United States population (283 million) for domestic indoor and outdoor residential uses. Other residences are self-supplied from wells or other sources; these withdrawals were about 1 percent (3.26 Bgal/d) of total withdrawals and provided water to about 13 percent (42.5 million) of the United States population. Groundwater was used for 98 percent of the self-supplied domestic withdrawals.

Withdrawals for **irrigation** were 37 percent (118 Bgal/d) of total withdrawals, and 42 percent of freshwater withdrawals. Lands irrigated with sprinkler or micro-irrigation systems accounted for 63 percent of total irrigated lands. Surface water supplied about 52 percent of the total irrigation withdrawals. The 17 conterminous Western States accounted for 81 percent of total irrigation withdrawals, and 74 percent of the total irrigated lands in the United States.

Withdrawals for **livestock** and **aquaculture** combined were 3 percent of the total withdrawals for all categories in 2015. Total withdrawals for livestock were 2.00 Bgal/d and 62 percent was from groundwater. Total withdrawals for aquaculture were 7.55 Bgal/d and 79 percent were from surface water.

Self-supplied industrial withdrawals were almost 5 percent (14.8 Bgal/d) of total withdrawals, and surface water provided 82 percent. Withdrawals for **mining** were about 1 percent (4.00 Bgal/d) of total withdrawals, and groundwater supplied 72 percent, mostly (65 percent) from saline water.

Water used for **thermoelectric power** accounted for 41 percent of total withdrawals (133 Bgal/d), and surface water supplied almost all withdrawals; 72 percent of the surface-water withdrawals were freshwater. Powerplants that used once-through cooling systems accounted for 96 percent of all thermoelectric-power withdrawals. More than 25 percent of thermoelectric-power withdrawals and power production was in Texas, Florida, Illinois, and Michigan.

Water Use Trends, 1950-2015

Every 5 years since 1950, the U.S. Geological Survey (USGS) has compiled and estimated water-use information in cooperation with State, Federal, and local agencies, making it possible to evaluate water-use trends through time. Total withdrawals steadily increased from 1950 (180 Bgal/d) to the peak in 1980 (430 Bgal/d), declined in 1985 (397 Bgal/d), and then remained fairly steady until 2005 (410 Bgal/d). The sharp decline in 2010 (354 Bgal/d) has continued through 2015 (322 Bgal/d). Total withdrawals for 2015 were lower than 1970, and were about the same as 1965 (310 Bgal/d). Thermoelectric-power withdrawals increased from 1950 to 1980, then fluctuated slightly through 2005, and since 2005 have declined sharply because of increased efficiency and closures of plants with once-through cooling systems. Irrigation withdrawals steadily increased from 1950 to 1980, when they peaked (150 Bgal/d), then remained steady through 2005 (127 Bgal/d), declined in 2010 (116 Bgal/d) and slightly increased in 2015 (118 Bgal/d). The trend toward using more efficient irrigation systems continued with 10 percent more irrigated lands using sprinkler systems (including micro-irrigation) in 2015 than in 2010; lands using surface (flood) irrigation systems decreased by 11 percent. Although population within the United States has steadily increased since 1950, public-supply withdrawals have varied. Public-supply withdrawals gradually increased from 1950 (14 Bgal/d), to a peak in 2005 (44.4 Bgal/d), decreased for the first time in 2010 (42.0 Bgal/d), and have continued to decrease at 7 percent in 2015 (39.0 Bgal/d). Less water was used for domestic purposes in 2015 than in 2010, which resulted in a decrease of the total domestic per-capita use rate from 88 gallons per capita per day (GPCD) in 2010, to 82 GPCD in 2015. Trends for combined categories of industrial, mining, aquaculture, livestock, and commercial (reported from 1985 to 1995), show that total combined withdrawals were steady from 1950 to 1985, then

decreased in 1985, mostly because of large decreases in industrial withdrawals between 1980 and 1985. This decreasing trend has continued until 2015, even though livestock, mining, and aquaculture uses have increased over time.

Importance of Water-Use Data for the United States

The most recent USGS publication of water-use data that is part of the series of reports that began in 1950, and is the basis of this summary, is USGS Circular 1441, "Estimated use of water in the United States in 2015" (Dieter and others, 2018) along with a data release (Dieter and others, 2017). Federal, State, and local agencies have a key role in the collection and dissemination of water-use data. By compiling and publishing water-use estimates for the Nation, the USGS provides water-resource planners with the information needed to address issues related to water-resource allocation and environmental effects at National, regional, and State levels. Water-use data also is a key component of the water-budget approach for the National Water Census (<http://water.usgs.gov/watercensus>), which is a primary effort of the USGS Water Availability and Use Science Program (<https://www.usgs.gov/science/mission-areas/water/water-availability-and-use-science-program>) that includes research to improve methods of collection and estimation of water-use data.

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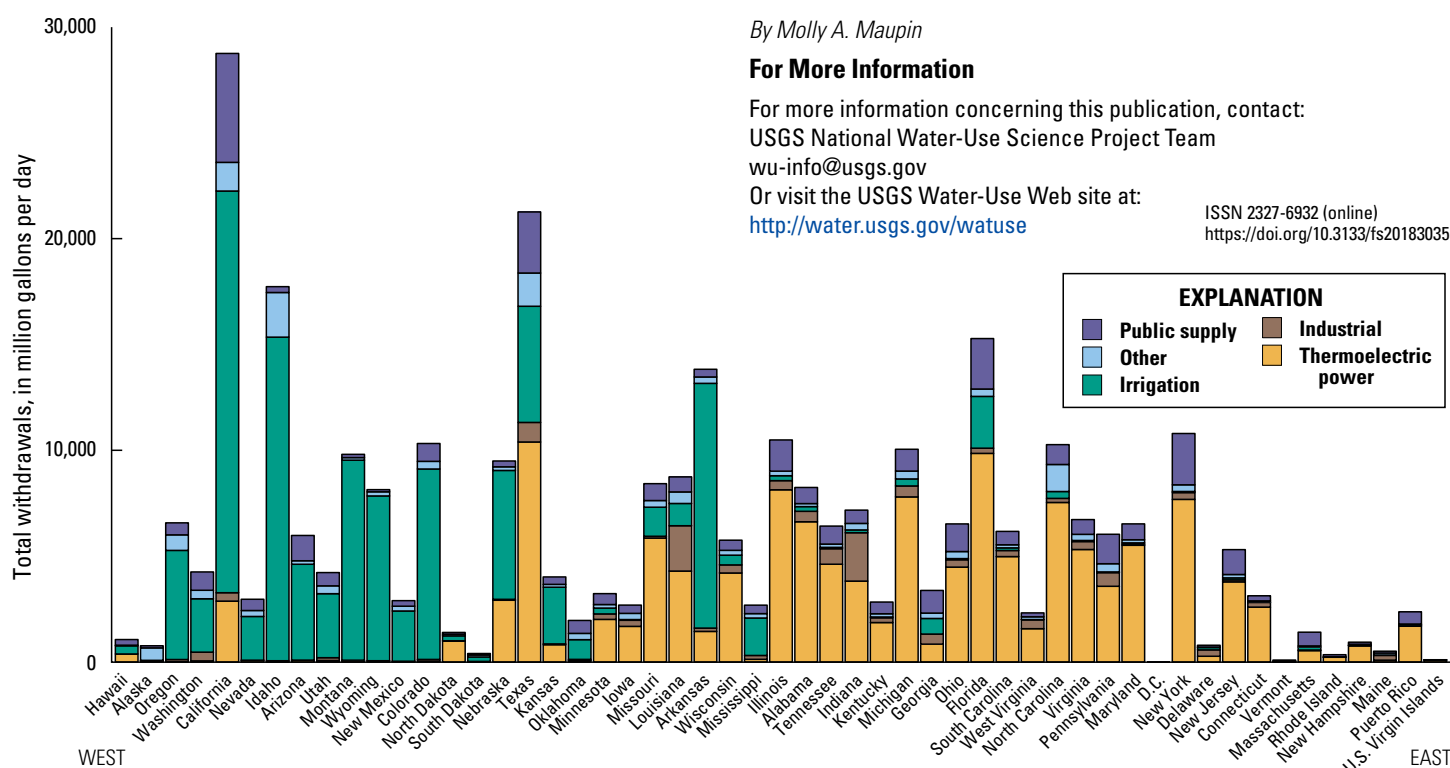
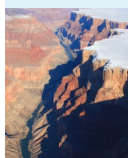
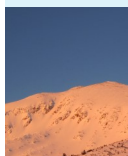


Figure 1. Withdrawals by category in 2015. States are arranged geographically from west to east. Units are in million gallons per day (Mgal/d); 1 billion gallon per day is equal to 1,000 Mgal/d.



► WHO WE ARE AND WHAT WE DO



► ADVISING WESTERN GOVERNORS ON WATER POLICIES, PROGRAMS AND LAWS

► RAISING WATER AS A HIGHER, PUBLIC POLICY PRIORITY



► PROTECTING STATES' WATER RIGHTS AND MANAGEMENT PREROGATIVES

► FOSTERING STATE AND FEDERAL COOPERATION

► PROMOTING SOUND SCIENCE AND DATA SHARING AND NETWORKS

WESTERN STATES WATER COUNCIL

WHO WE ARE 2019



Since its creation in 1965, the Western States Water Council (WSWC) has served as a resource and advisor on water policy issues for the governors. The Council now includes 18 western states. The governors are ex-officio WSWC members and appoint members to represent their individual states. Members serve at the pleasure of their respective governors and include state natural resource department directors, water resource agency directors, state engineers, state water quality managers, assistant attorneys general, private practice attorneys, and other western water experts. WSWC members are key decision-makers with access to their governor.

Water in the West

is an increasingly scarce and precious resource. Population growth, competing economic and ecological demands, and changing social values have left surface and ground water supplies stressed in many areas. This has increased the number and complexity of conflicts among users and uses. A secure water future is becoming more costly and increasingly uncertain given our unpredictable climate, aging and often inadequate infrastructure, data limitations regarding water supplies and demands, competing or poorly defined water rights, and a constantly evolving regulatory landscape. Effectively addressing these challenges requires stronger collaboration and cooperation that transcends political and geographic boundaries between states, federal agencies, tribes, and local communities.

The Council serves a number of governmental purposes on behalf of western states, with members advising the governors on planning, conservation, development, management, and protection of their water resources — to ensure that the West has an

adequate, sustainable supply of water of suitable quality to meet its diverse economic and environmental needs now and in the future. The Council fosters cooperation among member states and provides a forum for expressing a collective voice on federal water issues. It also facilitates the exchange of state views and experiences, fostering better state laws, management practices and policies. It assists states in monitoring and evaluating the impact of federal laws, programs and policies. It strives to elevate water as a higher public policy priority, impacting the economy, environment, public health, and the West's way of life.

State primacy is fundamental to a sustainable water future. States should be engaged early in meaningful consultation on federal policies and regulations, and federal actions should support state water laws, plans, policies, programs, water rights adjudications, court decrees, compacts and settlements.

Drought Management

The WSWC promotes coordinated drought planning and preparedness, with an emphasis on sharing data and improving drought forecasting. The National Integrated Drought Information System (NIDIS), led by the National Oceanic and Atmospheric Administration (NOAA), was created to develop an interagency, multi-partner approach to improving drought monitoring, early warning systems and forecasting. The WSWC has been an integral partner in helping implement NIDIS, as well as supporting NOAA's efforts to improve earth observations, drought prediction, and seasonal forecasting.



What We Do...



- **STATE WATER RIGHTS:** Numerous WSWC activities are designed to preserve the primary authority of the states to allocate and manage their waters, protect private property rights, and maintain water quality.
- **WATER TRANSFERS:** The WSWC supports voluntary, intrastate water rights transfers and has identified tools that states and others can use to avoid or mitigate the impacts of transfers on agricultural economies, rural communities, and the environment.
- **INDIAN WATER RIGHTS:** For over 30 years, the WSWC and the Native American Rights Fund (NARF) have worked together as part of an Ad Hoc Group on Indian Water Rights with Congress and the Administration to settle Indian reserved water rights claims through negotiation. The WSWC and NARF hold a biennial symposium on settlements, and the WSWC maintains a summary table of Congressionally-authorized settlements. Frequent interactions build relationships and trust, leading to results.
- **WATER REUSE:** Working with its members, the WSWC has published a comprehensive reference report describing the water reuse programs in 17 western states.
- **GROUNDWATER:** The WSWC has actively worked to protect the role of the States in allocating, managing and protecting groundwater resources and promoting recharge and conjunctive use.
- **WATER-RELATED DATA:** The WSWC has long worked with Congress and the Administration to secure adequate federal funding for data programs that support state water man-

agement, such as U.S. Geological Survey' stream-gaging system, Natural Resources Conservation Service' Snow Survey program, National Aeronautics and Space Administration's Landsat satellites, and various National Oceanic and Atmospheric Administration programs.

- **INFRASTRUCTURE STRATEGIES:** The WSWC has sponsored symposia on strategies to meet our present and future water infrastructure needs. The WSWC has promoted the expenditure of Reclamation Fund receipts for their authorized purposes, as well as EPA's State Revolving Funds and other federal water infrastructure development programs.
- **SYMPOSIA AND WORKSHOPS:** The WSWC sponsors a variety of symposia and workshops to bring together stakeholders from around the West to discuss water challenges. The WSWC has held meetings on improving and advancing sub-seasonal to seasonal precipitation forecasting, drought planning and preparedness, Federal water rights/needs, the energy/water nexus, water quality and water quantity protection and management, and other topics.
- **OTHER ORGANIZATIONS:** The WSWC collaborates with many academic, public and private, state and interstate organizations, and coordinates with a Western Federal Agency Support Team (WestFAST).

Demands on the West's limited water resources are growing and are complicated by population growth, extreme weather, and increasingly complex federal laws and regulations. These forces magnify the importance of regional cooperation to address common water problems and achieve solutions.

The Water Data Exchange: Getting the States Plugged In...

The Water Data Exchange (WaDE) is a cooperative effort between the WSWC, WestFAST, and its member states. Past efforts to categorize and quantify water availability and use for the western region have highlighted the lack of data and difficulty accessing what data is available to improve comprehensive analyses, planning and decision making. The WSWC's WaDE data-sharing program addresses this problem and the need to provide greater access to state and other authoritative water data. The goals of WaDE are to better enable the states to share important water data with each other, federal agencies and the public using a common format (water availability estimates, water use by sector, and water allocation data). The WSWC also encourages federal agencies throughout the West with water management responsibilities to share their information using "open data" strategies and standardized formats.



WaDE is a proactive effort that allows states to share data in a more streamlined, cost-effective, collaborative, and easily accessible framework. It positions the states ahead of time to answer important questions about water resources in the West on a regional, as well as state and local scale. States currently flowing data in the WaDE beta portal include Arizona, California, Colorado, Idaho, Kansas, Nebraska, Nevada, New Mexico, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. States who are working to engage in the WaDE program include Alaska, Montana and North Dakota.

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