

Summer 2017-03

RECLAMATION  
*Managing Water in the West*

# Knowledge Stream

Research and Development Office Magazine

***From the Regions***



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# Message from the Chief

Hello and welcome to the Summer 2017 issue of the *Knowledge Stream* magazine. This month we are showcasing research activities led by engineers and scientists in Region and Area Offices! While many of the projects funded by the Research and Development Office (R&D) are led by Reclamation's Technical Service Center staff focused on mission-critical field objectives, there are many high-priority projects led by engineers, scientists, and specialists within all of Reclamation's 17 Western States. Having this diversity of people, balancing operational responsibilities and technical innovation, is an ongoing credit and benefit to delivering water and power in an environmentally and economically sustainable manner in the West.

You will read about a wide range of projects addressing technical challenges affecting Reclamation's mission, including:

- Pacific Northwest Region teams developing innovative approaches to improve worker safety conditions at powerplants and dam facilities, as well as advancing decision-support tools to help water resource managers in the Columbia and Rogue River Basins more effectively plan for the future.
- Mid-Pacific Region staff supporting Central Valley Project (CVP) operations and CVP Improvement Act implementation by developing methods for automated refuge water supply data collection, management, and sharing.
- Lower Colorado Region teams developing employee-tailored hearing protection for use in powerplants, and also assessing opportunities to apply Unmanned Aircraft Systems for more reliable and safer data collection at Reclamation facilities.
- Upper Colorado Region specialists exploring how to integrate multiple innovative mapping technologies in order to develop high-resolution facility models (e.g., Elephant Butte and Glen Canyon Dams) that could improve facility design, operation, and maintenance.
- Great Plains Region teams developing decision-support tools to address water quality challenges in the Colorado-Big Thompson Project, and improving water treatment technology to address rural water scarcity for systems like those in North and South Dakota.

In addition to thanking regional staff who lead research and development efforts, we would also like to thank our bureau-wide team of Regional Science and Technology Coordinators, identified in this issue's "Community Needs" segment. Each regional coordinator provides an important role in identifying the right research, assisting its implementation, and ushering research results into use in the field. Their coordination efforts are an indispensable part of Reclamation's technical innovation success.

We hope you enjoy!

*Levi Brekke*  
Chief of R&D

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# Contents

## 02 Message from the Chief

## 04 Community Needs

Regionally Led Projects Provide Important Benefits

## 06 Key Perspectives

Current Status of Science and Technology Program Support for Unmanned Aircraft Systems Demonstration Projects

## 08 From the Regions

Pacific Northwest Region—Innovating Safety and Decisionmaking

Mid-Pacific Region—Automating Refuge Water Supply Data

Lower Colorado Region—Tailoring Employee Hearing Protection at Hydropower Facilities

Upper Colorado Region—Mapping Current Facility Conditions with Innovative Technologies

Great Plains Region—Addressing Environmental Compliance Challenges in Water Management

## 18 Technology Prize Competitions

Reclamation's Water Prize Competition Center Update

## 20 Featured Faces

Pacific Northwest (PN) Region: Jennifer M. Johnson and Jennifer Cuhacyan

Mid-Pacific (MP) Region: Jobaid Kabir and Rod Wittler

Lower Colorado (LC) Region: Nathaniel Gee and KayLee Nelson

Upper Colorado (UC) Region: Mark McKinstry and John Rice

Great Plains (GP) Region: Collins Balcombe and Jennifer Beardsley

## 22 Research Bulletins

Detecting Environmental Impacts of Invasive Mussel Infestations

Riparian Vegetation: Reclamation's Ally in River Restoration

Making Sense of Global Climate Change Projection Data

Using Tablet Computers for Field and Laboratory Work

## 23 About the *Knowledge Stream*

**JOHN WHITLER**

**in Reclamation's  
Research and  
Development Office  
served as topic editor  
for this issue**

**NEXT IN  
FISCAL YEAR 2017**

**Power and Energy  
(fall)**

# Community Needs

## Regionally Led Projects Provide Important Benefits

**P**rojects funded within Reclamation's Science and Technology (S&T) Program must have a Reclamation employee as the lead researcher. While the majority of S&T project leads are within Reclamation's Technical Service Center or Research and Development Office, regional employees are also encouraged to be lead researchers. There are numerous benefits to the S&T Program from having a regional employee as a lead researcher, including direct engagement with other regional staff, proximity to field locations or projects sites, and the ability to translate the research results into implementable actions to support Reclamation's mission.

Regional lead researchers also benefit from participating in the S&T Program. First, S&T Program-funded projects need to benefit multiple projects and/or multiple regions; this can encourage coordination across groups and regions to help solve problems. Second, supporting research and development activities can expand an employee's knowledge of a topic and/or help build problem solving skills that can be applied during their regular job duties. Third, having dedicated time and budget to spend on a specific issue of interest can help lead to solutions for that particular region and/or other regions while also helping Reclamation meet its mission goals. Everyone faces complex problems in their regular jobs, and conducting a research project to solve these problems can be remarkably satisfying.

Regional lead researchers may originate the ideas for their projects in a variety of ways. One way is through the "Regional Director Needs" process. In 2014, the S&T Program began the Regional Director Needs process as a way for Regional Directors to get their highest priority research needs addressed through an S&T Program-funded project. Each year, the S&T Program solicits these needs from the Regional Directors and announces them within its annual Call for Proposals. Proposals are then developed, submitted, and evaluated for funding. While someone outside of a region may be the lead researcher in a proposal, most often the lead is someone from the same region where the need is. The Regional Director Needs process has been an effective way for the S&T Program to support regional science needs in a targeted way that leads to solutions and beneficial impacts to Reclamation. Since 2015, the S&T Program has funded 24 Regional Director Needs projects. There are currently 11 active Regional Director Needs projects in fiscal year (FY) 2017, focusing on topics ranging from water treatment strategies to evaluating new battery technologies.

During the FY 2018 Call for Proposals (distributed in May 2017), an updated set of Regional Director Needs were identified. These needs relate to: Environmental Issues for Water Delivery and Management, Developing Water Supplies, Water Operations and Planning, and Water Infrastructure. While the needs identified may have been raised by a single region, these regionally led projects may have multi-region benefits and partners. Regionally led projects should be coordinated with the respective Regional S&T Coordinators shown on the next page. See the "About the Knowledge Stream" segment in this issue for Regional S&T Coordinators contact information.

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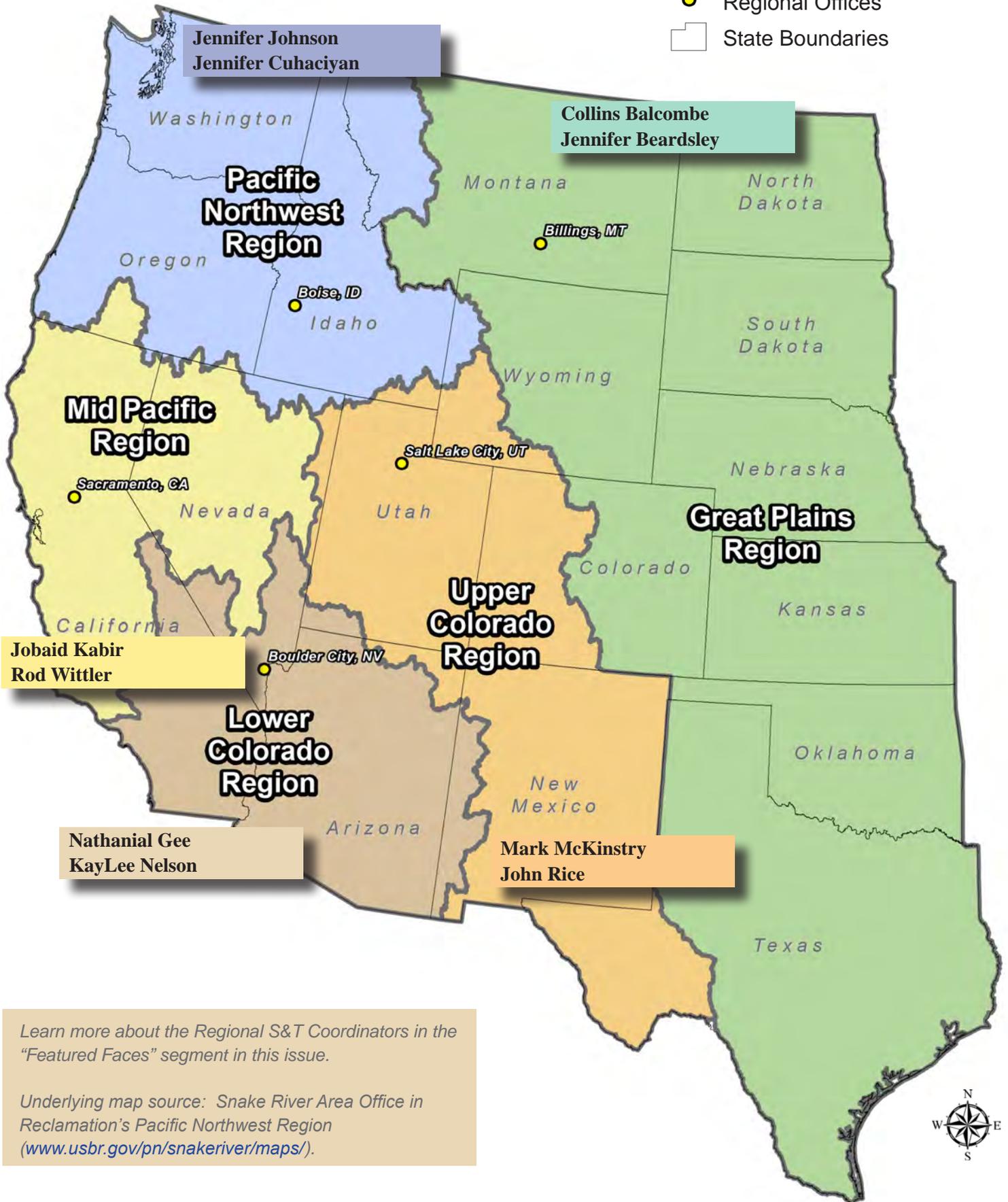
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S&T Program Science Strategy: [www.usbr.gov/research/st/docs/ST\\_Science\\_Strategy.pdf](http://www.usbr.gov/research/st/docs/ST_Science_Strategy.pdf)

## Reclamation Regions

- Regional Offices
- State Boundaries



Learn more about the Regional S&T Coordinators in the "Featured Faces" segment in this issue.

Underlying map source: Snake River Area Office in Reclamation's Pacific Northwest Region ([www.usbr.gov/pn/snakeriver/maps/](http://www.usbr.gov/pn/snakeriver/maps/)).

# Key Perspectives

## Current Status of Science and Technology Program Support for Unmanned Aircraft Systems Demonstration Projects

**U**nmanned Aircraft Systems (UAS), or commonly called drones, seem to be as ubiquitous as many other new technology devices in society today. Many already know of someone who has a UAS, or maybe a child, friend, or spouse that wants one as a gift. Using a UAS beyond a recreational hobby is becoming big business and applications throughout the commercial and public sector are becoming much more common. Relatively recent guidance by the Federal Aviation Administration (FAA) means these tools are considered aircraft and must be operated in accordance with FAA regulations.

On the surface, there appears to be a huge potential benefit for using UAS through Reclamation, albeit to obtain data not easily gathered in other ways or to reduce potential safety hazards of data collection currently performed manually. Reclamation's Science and Technology (S&T) Program has funded several efforts in recent years (referenced below) to demonstrate the effectiveness of UAS. These technologies, like other initiatives supporting Reclamation's mission, are another tool in the toolbox for Reclamation.

Active S&T Program research projects with a potential UAS component:

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- UAS Data Collection at Reclamation Sites (Principal Investigator Matthew Klein, Technical Service Center). This research project is providing comparable data to demonstrate whether using UAS for data collection is cheaper than traditional Reclamation methods. This project unites three distinct technical services at Reclamation's Technical Service Center (TSC) that promise to reap large benefits through the implementation of UAS technologies: facility condition assessments, geologic mapping and investigation, and geographic information system (GIS)/remote sensing. As a result of this project, there are now six carded U.S. Department of the Interior (DOI) UAS pilots and three approved airframes at TSC. More information: [www.usbr.gov/research/projects/detail.cfm?id=7104](http://www.usbr.gov/research/projects/detail.cfm?id=7104)
- Explore the Feasibility of Using Unmanned Aircraft Systems in Managing Rockfall Hazard Areas (Principal Investigator Kevin Tibbs, Lower Colorado Region). This research project is testing the practicality and capability of UAS to accurately map rockfall hazard areas, evaluate conditions of existing rockfall protection systems (rock bolts, nets, etc.), identify potential new rockfall risk areas, identify changes in rockfall hazard areas over time, and predict capabilities for areas that have the potential to become unstable. More information: [www.usbr.gov/research/projects/detail.cfm?id=7109](http://www.usbr.gov/research/projects/detail.cfm?id=7109)
- Impacts of Grade Control Structure Installations on Hydrology and Sediment Transport as an Adaptive Management Strategy During Climate Change (Principal Investigator Deborah Tosline, Lower Colorado Region). Instead of collecting data manually, this research project is exploring a partnership with the U.S. Geological Survey to access desired data using automated methods, such as UAS. More information: [www.usbr.gov/research/projects/detail.cfm?id=1751](http://www.usbr.gov/research/projects/detail.cfm?id=1751)

—continued on page 7

—continued from page 6

- Facility Management of Reclamation’s Dams - The Unified Intelligent Model (Principal Investigator David Winslow, Upper Colorado Region). This research project is using UAS, helicopters, boats, and other equipment to capture the interior and exterior of Glen Canyon Dam (Arizona) to create an intelligent three-dimensional model of the facility with overlays for operation and maintenance, facility management, security, power distribution, and Geographic Information System. More information: [www.usbr.gov/research/projects/detail.cfm?id=9748](http://www.usbr.gov/research/projects/detail.cfm?id=9748)

An important aspect of UAS work is to ensure all proper procedures and policies are followed, and that Reclamation’s National and Regional Aviation Managers (see “more information”) are aware of and approve the work. Depending on the complexity of the project and the plan for execution, DOI’s Office of Aviation Services may also need to approve the project. These approvals must occur if the work is performed by Reclamation, or by a contractor.

Reclamation’s TSC and several of its regions are building capacity to support UAS missions, which will allow staff to use these services without training as well as the ability to purchase equipment themselves. When the S&T Program receives a proposal involving UAS work, it is coordinated with Reclamation’s Security, Safety, and Law Enforcement Office to review. The National and Regional Aviation Managers should also be consulted about any UAS-related work to ensure that, if the proposal is funded, the proper approvals can be acquired to proceed with the proposed work.

Key documents to be aware of when preparing a proposal for the S&T Program that involves a UAS:

- *DOI Operational Procedures Memorandum (OPM)–11*, “DOI Use of Unmanned Aircraft Systems (UAS).” Governs all UAS activities within DOI: [www.doi.gov/sites/doi.gov/files/uploads/opm-11.pdf](http://www.doi.gov/sites/doi.gov/files/uploads/opm-11.pdf)
- *DOI Operational Procedures Memorandum (OPM)–04*, “Aviation User Training Program.” Governs all training requirements for aviation within DOI (the appendix tables are particularly helpful): [www.doi.gov/sites/doi.gov/files/uploads/opm-04.pdf](http://www.doi.gov/sites/doi.gov/files/uploads/opm-04.pdf)
- DOI’s Office of Aviation Services Document Library. Includes all DOI policy and handbooks: [www.doi.gov/aviation/library/](http://www.doi.gov/aviation/library/)
- *Reclamation Memorandum*, “Unmanned Aircraft Systems.” Minimum guidance for a case-by-case review of UAS projects. This guidance should be thoroughly addressed when planning for any UAS projects (access available to Reclamation employees only): <https://drive.google.com/file/d/0B1kG9U-E0F0gR1haZi1LZfJcRXiGRGJOZG5pUkIzNU5KX1N3/view>
- *Reclamation Memorandum*, “Reclamation Aviation Management Plan” (access available to Reclamation employees only): <https://drive.google.com/file/d/0B1kG9U-E0F0gRkJoZDBDLUd5YVE/view?pli=1>



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- Larry Welch – Mid-Pacific Region
- Scott Wells – Lower Colorado Region
- Shellie Nall – Upper Colorado Region

# From the Regions

## Pacific Northwest Region— Innovating Safety and Decisionmaking

**T**he Pacific Northwest (PN) Region is responsible for operation and maintenance of dams and streams in the Columbia and Rogue Rivers Basins in five states: Washington, Oregon, Idaho, Montana, and Wyoming. While coordinating with other Federal and state agencies, public utilities, and Tribes, the region manages broad issues including flood control, water supply, hydropower, and environmental issues. Recently, research and development through Reclamation's Science and Technology (S&T) Program has improved the region's ability to carry out Reclamation's mission by improving safety conditions and helping plan for the future. Researchers in the region have partnered with Reclamation's Technical Service Center (TSC), universities, other Federal agencies, and Tribes to investigate a wide range of topics.

Safety is a core value of the PN Region, and several S&T Program research projects have been conducted to improve safety throughout the region. Research projects have included understanding and improving the safety culture, developing engineering controls to prevent long-term hearing loss, and developing techniques to use Unmanned Aircraft Systems to collect data in places that are difficult or dangerous to access. The region has partnered with the University of North Carolina, Office of Naval Research, and TSC to conduct this research work.

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projects/detail.cfm?id=7252](http://www.usbr.gov/research/projects/detail.cfm?id=7252)

Project ID 9682:  
[www.usbr.gov/research/  
projects/detail.cfm?id=9682](http://www.usbr.gov/research/projects/detail.cfm?id=9682)

Project ID 1603:  
[www.usbr.gov/research/  
projects/detail.cfm?id=1603](http://www.usbr.gov/research/projects/detail.cfm?id=1603)



*Developing Engineering Controls to Prevent Long-Term Hearing Loss—high transmission loss panels.*

Many research projects have been developed to support decisionmakers in water management and planning. A number of research projects have focused on reducing risk to water supply through the development of new forecasting techniques at various time scales. The PN Region has partnered with the U.S. Department of Agriculture’s Agricultural Research Service and Boise State University to develop these techniques and test them in real-time operations. The focus of another research project, at the other end of the decision-support spectrum, is identifying and developing more effective methods for communicating complex scientific information, such as that associated with water planning studies. This research project is currently using the Deschutes Basin Study as a case study for this effort.

In response to the unprecedented 2017 spring runoff conditions and the challenges it posed to reservoir operations throughout the Pacific Northwest, the region plans to pursue new research over the coming years to identify options for improved reservoir operations under more extreme and changing conditions.



*Lorri Gray, PN Regional Director, talks safety with Brandt Demars, Program Manager of the PN Region’s Construction Engineering Office, at the Minidoka Dam construction site in Idaho. Photograph by Kirsten Strough, PN Regional Office.*

*A partnership with the University of North Carolina has evaluated the safety culture in the PN Region at various worksites under varying conditions. Christopher Cuhaciyon (Principal Investigator, PN Region) led this study, one of the S&T Program’s Regional Director Needs projects, and worked to understand the current culture in the region in order to make recommendations for improvement. Future work will include pilot investigations of the recommendations. Refer to Reclamation’s S&T Program Research Project, “Safety Benchmarking Study,” Project ID 7252.*

## Mid-Pacific Region— Automating Refuge Water Supply Data

**T**he Mid-Pacific (MP) Region covers the northern two-thirds of California, most of western Nevada, and part of southern Oregon. The region fulfills water obligations for agriculture, power generation, water conservation, and water recycling and reuse while protecting natural and federally protected cultural resources.



*Waterfowl flying at dusk over the Merced National Wildlife Refuge (California), 1 of 19 refuges dually managed by Reclamation and FWS as mandated by the 1992 CVPIA. Photograph by Lloyd Hall, retired.*

The MP Region's Central Valley Project (CVP), built for flood control and irrigation, is one of the largest water storage and transport systems in the world. The CVP includes 20 reservoirs, 11 powerplants, and over 500 miles of canals and aqueducts. It has a combined storage capacity of more than 11 million acre-feet of water and serves farms, homes, and industries in California. It is the primary source of water for much of California's wetlands, agriculture, cities, industries, and the environment while providing hydropower, flood protection, navigation, recreation, and water quality benefits.

Reclamation's Science and Technology (S&T) Program-funded research has improved

operations and management of the CVP as a critical water project in the MP Region by supporting partnerships with researchers in Reclamation's Technical Service Center, universities, and state and Federal agencies.

With the signing of the Central Valley Project Improvement Act (CVPIA) in 1992, Reclamation was tasked with providing the means to deliver CVP water for an additional 19 U.S. Fish and Wildlife Service (FWS) refuges in the Central Valley of California for the benefit of migrating waterfowl. A reliable water supply allowed these refuges to maintain habitat and expand healthy populations of bird species. Reclamation and FWS jointly manage the refuge water supply program to administer delivery and acquisition goals. In total, the CVPIA mandates the delivery of 555,515 acre-feet of water annually from CVP supplies and purchased water from willing sellers.

Reclamation initiated construction projects and entered into conveyance and acquisition contracts to deliver water to these refuges. Since CVP supplies account for a portion of the refuges' needs, legislation required the purchase of additional sources of water,

*—continued on page 11*

—continued from page 10

source and methodology to account for water, which can vary from year to year. During the recent California drought, Reclamation established various water exchanges and facilitated groundwater pumping for enhancing refuge water supplies that added to the complexity of water accounting. It is expected that similar, unusual actions will persist during future droughts.

Currently, CVPIA maintains water accounting using a series of spreadsheets. In the early years of the program, the spreadsheet-based accounting was adequate as there was little annual variations in water sources or drought conditions. However, as the program matured so did the complexities related to growing water supply during increasingly scarce conditions. As a result, the water accounting system now requires the advanced input and skillful selection of data without institutional knowledge, such as the ability to recall and record the circumstances surrounding unusual conditions and decisions so that the record is accurate and information can be excreted when necessary.

Using funding provided by the S&T Program, the MP Region is currently developing a database to facilitate archival of delivery data, the associated attributes, and the decisions that affect them. This database will enable a secure method of data storage while simplifying the information retrieval without institutional knowledge. The database will be completed during fiscal year 2017.



*A Black Neck Stilt feasts in the waters of the Merced National Wildlife Refuge (California), part of the MP Region's CVP that benefits from Reclamation's S&T Program-funded research. Photograph by Lloyd Hall, retired.*

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projects/detail.cfm?id=3764](http://www.usbr.gov/research/projects/detail.cfm?id=3764)

## Lower Colorado Region— Tailoring Employee Hearing Protection at Hydropower Facilities

**T**he Lower Colorado (LC) Region encompasses southern Nevada, southern California, most of Arizona, a small corner of southwest Utah, and a small section of west-central New Mexico. The region's programs and projects cover over 202,000 square miles of the West, with focus on the lower 688 river miles of the Colorado River system from Lee's Ferry in northern Arizona to the border with the Republic of Mexico. In a typical year, Reclamation facilities in the region deliver 7.5 million acre-feet (maf) of water to Arizona, California, and Nevada, and 1.5 maf to Mexico. The water helps irrigate over 2.5 million acres of land and meet the domestic needs of more than 23 million people. Hydroelectric powerplants at Hoover, Davis, and Parker Dams annually generate five to six billion kilowatt-hours of clean, hydroelectric power distributed to contractors in Arizona, Nevada, and California.

Since 2014, the LC Region has benefited from Reclamation's Science and Technology (S&T) Program, specifically Regional Director Needs-supported projects. As any region does, the LC Region faces many issues that are specific to the duties of the region, as well as the geographic area of the region.

The LC Region is committed to improving the safety and health of employees, contractors, and visitors to the region. In response to a recent safety evaluation by the region's Safety and Occupational Health Office, two Regional Director Needs-supported projects are currently ongoing. One safety-focused research project is exploring the

quality of hearing protection by using an innovative testing system such as the 3M™ E-A-Rfit™ Dual-Ear Validation System, which allows viable data to test both ears of an employee to ensure facility hearing protection is proper for that specific employee. To date, 43 employees have been tested with the system and the results demonstrated that the hearing protection provided by the facility only properly fitted approximately a quarter of the tested employees. This research project also involves testing employees using similar technologies, evaluating and comparing the results, and determining the best hearing protection for employees to use in order to prevent possible hearing loss due to noise levels at facilities. The second safety-focused research project is exploring preventative measures for accidents related to the working environment. Within



*The 3M™ E-A-Rfit™ Dual-Ear Validation System—a Regional Director Needs-supported project in the LC Region that is exploring the quality of hearing protection by using this innovative testing system, which allows viable data to test both ears of an employee to ensure individualized hearing protection.*

—continued on page 13

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*Ergonomic evaluations are conducted to ascertain if using equipment to reduce ergonomic hazards such as over-extension, above-head, bending, or twisting is possible. This photograph was captured of employees at Hoover Dam to determine possible equipment use and/or to suggest alternative method(s) to conduct the same work.*

—continued from page 12

the LC Region, ergonomic injuries related to strains and exertion are the top 2 of 3 injuries in the last 20 years. This research project is specifically exploring the use of ergonomic tools—such as force gauges—to lessen muscle fatigue, reduce stress from joints, and eliminate lower back pain, as well as investigating whether or not using these tools will prevent ergonomic-related injuries. Process-based assessments were completed on different working groups within the facility that determined only labor and warehouse crews are able to apply such tools.

Another ongoing Regional Director Needs-supported project in the LC Region that was made possible due to S&T Program funding is exploring Unmanned Aircraft Systems (UAS) to carry out many different Reclamation mission activities. Much of Reclamation's mission involves collecting data in support of analysis and decisionmaking. Activities performed in the field can put employees at risk—from operating motor vehicles to accessing inaccessible features via ropes. UAS show promise to supplement and/or replace employees on some mission work, which means exposing them to less risk. UAS can also collect higher quality data (either due to proximity to a particular feature or via advanced sensors) and types of data that may not be obtainable otherwise, which can be input into data analysis software to create tools to inform data-driven decisions.

The LC region is actively researching areas where regional issues can be addressed and/or resolved. The S&T Program research projects discussed above were all submitted as Regional Director Needs-supported projects that attest the LC Region is committed to exploring how the region as a whole can become safer in daily mission activities. Expectantly, the outcomes of these projects could be applied to other regions and agencies to also strive for a safer working environment for all.

## More Information

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# Upper Colorado Region— Mapping Current Facility Conditions with Innovative Technologies

**T**he Upper Colorado (UC) Region, headquartered in Salt Lake City, Utah, includes southwest Wyoming, Colorado west of the Continental Divide, the State of Utah, small portions of Arizona, and New Mexico and Texas west of the Pecos River. The region administers 61 dams, delivers 12.6 million acre-feet of water per year, irrigates over 3.5 million acres of farmland, provides recreation opportunities for millions, and generates hydropower that would take three million tons of coal or 10.5 million barrels of oil each year to replace.

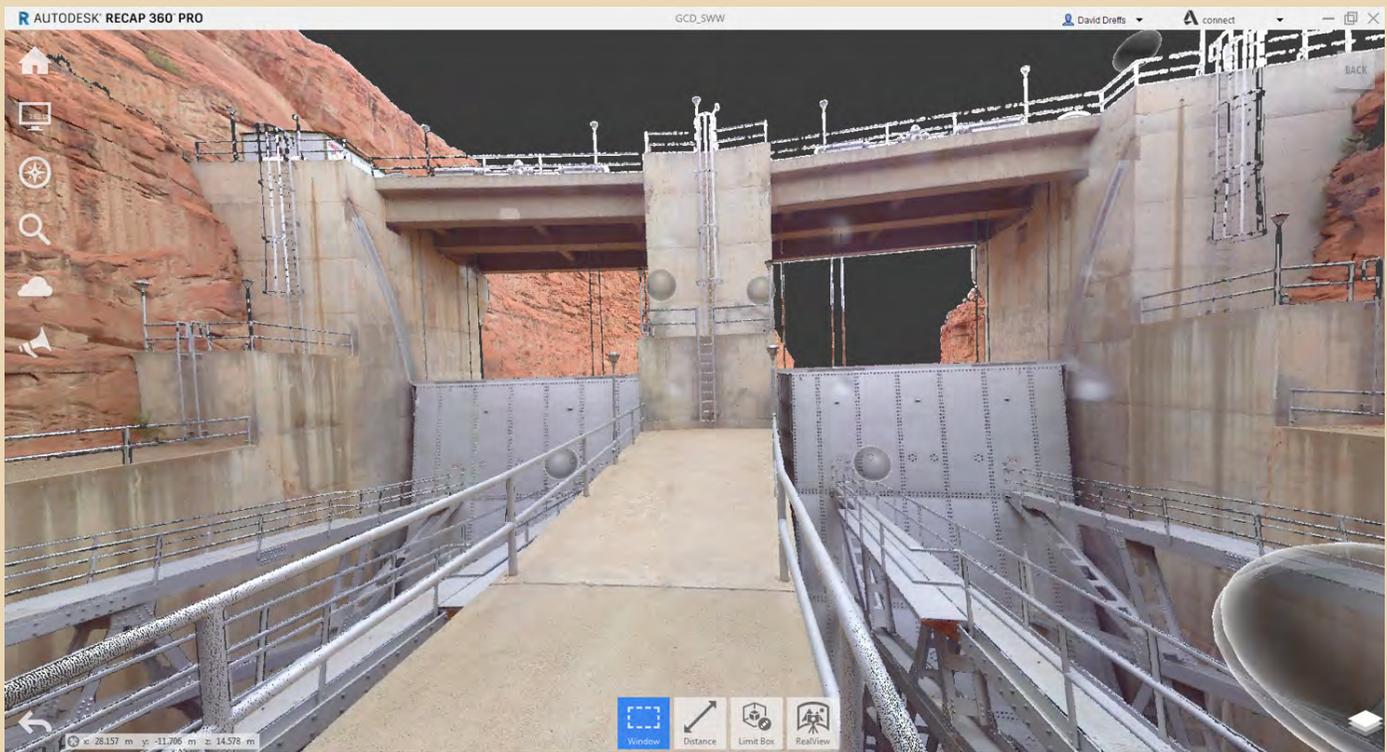
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Many UC Region facilities consist of large-scale structures that are time-consuming to inspect and require special safety equipment and procedures to physically access. Manned rope access teams have to perform inspections and measuring by hand, which take time, are costly, and increase risks for inspectors. In addition, facility condition assessments require complex planning and take time to execute as well.

Reclamation's Science and Technology (S&T) Program recently funded a research project in the UC Region that explored Unmanned Aircraft Systems (UAS) and photogrammetry as a condition assessment tool. Although both of these technologies are relatively new for Reclamation in terms of innovating facility inspections, in fiscal year 2016 this research project was conducted to determine if UAS could be used to collect quality inspection data, including data for photogrammetry.



Autodesk rendering of Glen Canyon Dam, Arizona.

Elephant Butte Dam (New Mexico) was identified for an aerial inspection due to its age, now over 100 years old, as well as its simple plan layout and tall, inaccessible downstream dam face. In addition, the structure was showing signs of deterioration that would provide a real world test of UAS inspection capabilities. This research project showed that UAS data collection can be reliably conducted to provide high-quality data for inspections, and also underscored Reclamation's need for an internal UAS program.



*Georeferenced 3D model of Elephant Butte Dam, New Mexico.*

Another recent S&T Program-funded research project relates to developing a comprehensive, facility-wide three-dimensional (3D) model of the current conditions of Glen Canyon Dam and Powerplant (Arizona). This research project is focusing on employing laser, photography, and Sonar data capture tools and using building information and other Autodesk commercial off-the-shelf software. Additionally, another key objective is ensuring knowledge transfer to Reclamation personnel.

Benefits of the research to Reclamation are:

- Unifying 3D building information at the facility level versus individual systems, components, or drawings
- Enhancing facility management and operation and maintenance capabilities by non-CAD personnel via improved understanding of current facility conditions by using reality capture data visualization
- Increasing security management and access information for emergency responder services
- Improving asset management and potential connection to Maximo databases

Look for more information about this research project in the next issue of the *Knowledge Stream*.

## More Information

S&T Program Research Projects:

Project ID 7738: [www.usbr.gov/research/projects/detail.cfm?id=7738](http://www.usbr.gov/research/projects/detail.cfm?id=7738)

Project ID 9748: [www.usbr.gov/research/projects/detail.cfm?id=9748](http://www.usbr.gov/research/projects/detail.cfm?id=9748)

## Contributors

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## Great Plains Region— Addressing Environmental Compliance Challenges in Water Management

**T**he Great Plains (GP) Region encompasses all or parts of nine states, including Montana, North Dakota, South Dakota, Wyoming, Colorado, Nebraska, Kansas, Oklahoma, and Texas, and operates 20 hydroelectric powerplants that produce enough electricity to meet the demands of more than 250,000 homes each year.

The GP Region leverages new research opportunities under Reclamation's Science and Technology (S&T) Program. Aside from prioritizing the complex array of challenges, two key factors are always at the forefront: (1) how can the region effectively conduct research given the limited staff and (2) what are the chances of success in terms of yielding a return on investment? In the end, the hope is that with a minimal investment on the front-end, resources can be saved down the road by finding faster, better, and cheaper ways of meeting Reclamation's mission.

Since 2014, the S&T Program has funded five research projects that specifically target Regional Director Needs. One of these research projects has been completed and four are currently underway and scheduled for completion by the end of fiscal year (FY) 2017. Like the GP Region and its array of challenges, the focus of Regional Director Needs research varies widely too.



*An Electrodialysis Reversal Desalination Unit—A water treatment challenge in the GP Region in which the Oklahoma-Texas Area Office hired TSC to help optimize this unit to remove salts at Foss Reservoir, Washita Basin Project, Oklahoma.*

In 2014, the Eastern Colorado Area Office (ECAO) developed a Geographic Information System-based land cover and refined Soil and Water Assessment Tool model to identify and potentially help manage non-point pollution sources affecting the clarity of Grand Lake, a prominent feature of the Colorado-Big Thompson (C-BT) Project. The new modeling tool helps stakeholders identify and address ongoing water quality challenges both at the C-BT Project and beyond.

In 2015, ECAO expanded its efforts under the S&T Program to address oxygenation issues at the C-BT Project and then the Dakotas Area Office followed suit by launching an effort to identify and reduce potentially harmful disinfection byproducts in a regional rural water system. Both studies are ongoing and scheduled for completion by the end of FY 2017. In addition to the promising outcomes these efforts hope to achieve, they highlight the importance of being able to map needs with opportunities, not just under the S&T Program. For challenging issues related to water treatment, the GP Region is doing just that. By recognizing the important role water treatment plays in accomplishing Reclamation's mission, the region set out to develop a framework on how to bring those critical needs to the forefront and, more importantly, identify ways to solve them. By the end of the year, the region hopes to outline a clearer path on how to match mission-critical needs with internal programs and expertise available at its fingertips. Doing so will help all of Reclamation, not just the GP Region, tap into the pool of experts at Reclamation's Technical Service Center (TSC), and help prioritize and jump start future projects.

Another research project, started in late 2016, strives to improve how the GP Region manages the complex world of environmental compliance audits. With more than 150 major water storage and delivery structures and 21 hydropower facilities, the region's Environmental Compliance Audit Program handles a massive volume of data, reports, and correspondence. The region hopes it can improve how this information is collected and managed while ensuring compliance with the Reclamation Manual. The region is currently coordinating with programming experts at TSC to review needs and determine the best platform to meet its needs.

Looking towards the future, opportunities abound on ways to improve how to do business and implement research projects that maximize return on investment. In the S&T Program's FY 2018 Call for Proposals, the GP Region will call upon Reclamation experts and partners to help the region address key issues related to:

1. Understanding early life development of the pallid sturgeon and like species with similar life history and needs
2. Improving early detection technologies for surface water hydrocarbon contamination and emergency response
3. Developing a better understanding of how benefits and costs can be measured for regional rural water projects
4. Detecting and confirming, with more efficiency and reliability, the presence of invasive mussels

## Contacts

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Natural Resource Specialist  
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## More Information

S&T Program Research  
Projects:  
Project ID 6988:  
[www.usbr.gov/research/  
projects/detail.cfm?id=6988](http://www.usbr.gov/research/projects/detail.cfm?id=6988)

Project ID 8154:  
[www.usbr.gov/research/  
projects/detail.cfm?id=8154](http://www.usbr.gov/research/projects/detail.cfm?id=8154)

Project ID 7115:  
[www.usbr.gov/research/  
projects/detail.cfm?id=7115](http://www.usbr.gov/research/projects/detail.cfm?id=7115)

# Technology Prize Competitions

## Reclamation's Water Prize Competition Center Update

**R**eclamation's Water Prize Competition Center has launched the following prize competitions seeking citizen solvers who can find innovative solutions for some of the most critical water storage and delivery infrastructure, and water- and environmental-related resource problems facing the Nation.



### *Infrastructure Sustainability Theme Area*

#### **Long-Term Corrosion Protection of Existing Hydraulic Steel Structures – Stage 1**

**Closes September 5, 2017**

Maintenance and replacement costs for existing corrosion control systems have increased greatly in recent decades due to increasing health, safety, and environmental concerns associated with coatings as well as the decreased life cycles of commercially available alternative coatings. New long-term solutions to protect steel structures in water immersion service will help reduce the high cost incurred to keep steel infrastructure reliable and functional.

Prize Competition Team Leads: Jessica Torrey | [jtorrey@usbr.gov](mailto:jtorrey@usbr.gov)  
Bobbi Jo Merten | [bmerten@usbr.gov](mailto:bmerten@usbr.gov)

Learn more at: [www.usbr.gov/research/challenges/corrosion.html](http://www.usbr.gov/research/challenges/corrosion.html)



### *Water Availability Theme Area*

#### **Sub-Seasonal Climate Forecast Rodeo**

**Closes May 3, 2018**

Launched in December 2016, this prize competition is in full swing with up to \$800,000 in cash prizes at stake. This year-long, real-time forecasting competition focuses on Western United States temperature and precipitation. To be eligible for cash prizes, teams must outperform existing benchmark forecasts. Follow the scores, rankings, and forecast visualizations at the National Integrated Drought Information System's hosting webpage at: [www.drought.gov/drought/sub-seasonal-climate-forecast-rodeo](http://www.drought.gov/drought/sub-seasonal-climate-forecast-rodeo).

Prize Competition Team Lead: Kenneth Nowak | [knowak@usbr.gov](mailto:knowak@usbr.gov)  
Learn more at: [www.usbr.gov/research/challenges/forecastrodeo.html](http://www.usbr.gov/research/challenges/forecastrodeo.html)

### **Water Prize Competition Center Contact**

Chuck Hennig, Deputy Chief and Prize Competitions Coordinator  
303-445-2134 | [chennig@usbr.gov](mailto:chennig@usbr.gov)

### **More Information**

[www.usbr.gov/research/challenges](http://www.usbr.gov/research/challenges)

### *Ecosystem Restoration Theme Area*

#### **UPDATE: Downstream Fish Passage at Tall Dams Awards Closed May 10, 2016**

Reclamation collaborated with the U.S. Geological Survey, National Oceanic and Atmospheric Administration's National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the U.S. Army Corps of Engineers to design and judge this prize competition. A total of 59 ideas were submitted from potential solvers.

#### **First Place \$10,000 | Briana Connors | Cincinnati, Ohio**

Solution: Use a drag conveyor to pass fish downstream to offer continuous and rapid transport as well as manage pressure within the chambers to minimize trauma to the fish. Connors said, "My proposed solution uses solutions I have seen in food and chemical plant designs for inspiration. Prior to reading the problem statement, I was not aware of how much resources went into fish relocation at dams."

#### **Second Place \$4,000 | Ted R. Grygar | San Diego, California**

Solution: Use an Archimedean internal helical device to move small fish downstream past high-head dams. With a background in physics and mechanical and electrical engineering, Grygar was motivated to enter this prize competition because he could "participate in a field never experienced in my work history."

#### **Third Place \$3,500 | Joseph Rizzi | Benicia, California**

Solution: Use nets to guide fish to multiple points, and a flexible pipe attached to a buoy to convey the fish through the dam abutment to the river downstream in atmospheric conditions. Rizzi was intrigued by this prize competition in order to "help Reclamation help the fish. Dams are important and can be made fish friendly too."

#### **Fourth Place \$2,500 | Kenneth Smith | Colfax, Wisconsin**

Solution: Develop a system that uses innovative ways of attracting fish to a collection location, particularly the use of cover, and protecting them from predators at that location. Smith said, "I have long been active with inventing, entrepreneurship, and social and environmental stewardship."

Although only four ideas were selected, the Federal Government receives a perpetual, no-cost right to use any of the ideas submitted. Reclamation will now develop a plan to further test, develop, and demonstrate the effectiveness of these submitted ideas.

Prize Competition Team Lead: Connie Svoboda | [csvoboda@usbr.gov](mailto:csvoboda@usbr.gov)

Learn more at: [www.usbr.gov/research/challenges/fishpassage.html](http://www.usbr.gov/research/challenges/fishpassage.html)

### *Water Availability Theme Area*

#### **UPCOMING: Pathogen Monitoring for Potable Water Reuse – Stage 1**

Prize Competition Team Lead: Andrew Tiffenbach | [atiffenbach@usbr.gov](mailto:atiffenbach@usbr.gov)

Learn more at: [www.usbr.gov/research/challenges/pathogen.html](http://www.usbr.gov/research/challenges/pathogen.html)

#### **UPCOMING: Colorado River Basin Data Visualization Challenge**

Prize Competition Team Leads: Allison Danner | [adanner@usbr.gov](mailto:adanner@usbr.gov)

Ian Ferguson | [iferguson@usbr.gov](mailto:iferguson@usbr.gov)

Learn more at: [www.usbr.gov/research/challenges/datavis.html](http://www.usbr.gov/research/challenges/datavis.html)

#### **UPCOMING: Lowering the Cost of Continuous Streamflow Monitoring**

Prize Competition Team Lead: Ian Ferguson | [iferguson@usbr.gov](mailto:iferguson@usbr.gov)

Learn more at: [www.usbr.gov/research/challenges/streamflow.html](http://www.usbr.gov/research/challenges/streamflow.html)



*The Downstream Fish Passage at Tall Dams' Prize Competition was developed to help migrating juvenile fish over or around tall (high-head) dams.*

# Featured Faces

The Regional Science and Technology (S&T) Coordinator role began several years ago to facilitate better connections between S&T Program projects and Regional, Area, and Field Offices. With the entire Research and Development Office staff in Denver, Colorado, having regional liaisons to support collaboration and coordination with and between staff within all of Reclamation has proven to be extremely valuable.

The Regional S&T Coordinator role has grown over time since the Research and Development Office believes S&T Program projects are most successful when they have a Regional/Area/Field Office connection. For this reason, there are now two coordinators for each of the five regions. Their work directly supports the S&T Program, providing the Research and Development Office with the “eyes and ears” in each region.



## **Pacific Northwest (PN) Region**

### **Jennifer M. Johnson**

Jennifer Johnson is a Hydrologic Engineer in the PN Regional Office’s River and Reservoir Operations Group in Boise, Idaho, and, in 2016, became the supervisor of the group’s modeling team. Jennifer started working on S&T projects and applying for S&T grants in 2007, and has been the PN Regional S&T Coordinator since 2009. As the PN Regional S&T Coordinator, she assists with proposal writing, coordinates research projects that are the priority of the PN Regional Director, and helps to facilitate communications between PN researchers and the Research and Development Office. Recently, she has worked with the MP Region to begin developing cross-regional research project teams that work to solve problems in multiple regions simultaneously.



### **Jennifer Cuhaciyan**

Jennifer Cuhaciyan is a Civil Engineer in the PN Regional Office in Boise, Idaho. Jennifer became the co-Regional S&T Coordinator for the PN Region in 2016.



## **Mid-Pacific (MP) Region**

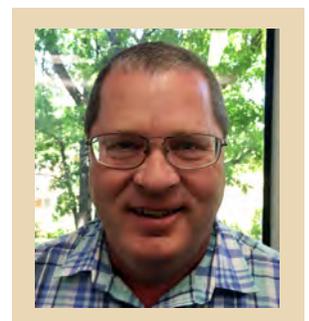
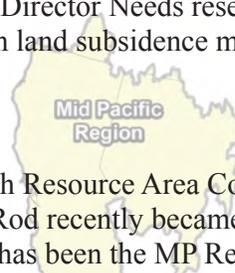
### **Jobaid Kabir**

Jobaid Kabir is the Chief of the Decision Analysis Branch in the MP Regional Office in Sacramento, California. Jobaid became involved in the S&T Program shortly after joining Reclamation in 2010 and began serving as the MP Regional S&T Coordinator soon afterward. His duties in support of the S&T Program include reviewing and evaluating research proposals, encouraging staff in the MP Region to submit proposals for funding, and coordinating and/or working with other regional coordinators to develop multi-regional proposals for Reclamation, such as the recent multi-regional proposals on methyl mercury modeling for reservoirs. In addition, he coordinated the development of the MP Regional Director Needs research project proposals for the Delta Cross Channel fish barrier, San Joaquin land subsidence modeling, and modeling impact of forest fires on reservoir mercury loading.



### **Rod Wittler**

Rod Wittler is the Central Valley Project Improvement Act Fish Resource Area Coordinator in the MP Regional Office in Sacramento, California. Although Rod recently became the co-Regional S&T Coordinator for the MP Region in 2016, he has been the MP Region Science Liaison to the Research and Development Office for several years. As the MP Region Science Liaison, he serves all of the regions offering expertise in various disciplines, furthermore specializing in river restoration issues related to hydraulics, fisheries management, and adaptive management.



## Lower Colorado (LC) Region

### Nathaniel Gee

Nathaniel Gee is the Manager of the Safety of Dams and Examination of Existing Structures Group in the LC Regional Office in Boulder City, Nevada. Nathaniel became involved in the S&T Program shortly after joining Reclamation in 2011, when he began serving as the LC Regional S&T Coordinator. His duties in support of the S&T Program include reviewing and evaluating research proposals, encouraging staff in the LC Region to submit proposals for funding, and working with other regional coordinators to develop multi-regional proposals for Reclamation.



### KayLee Nelson

KayLee Nelson is a Program Analyst for the Portfolio, Project, and Business Management Group in the LC Regional Office in Boulder City, Nevada. KayLee became the co-Regional S&T Coordinator for the LC Region in 2016.



## Upper Colorado (UC) Region

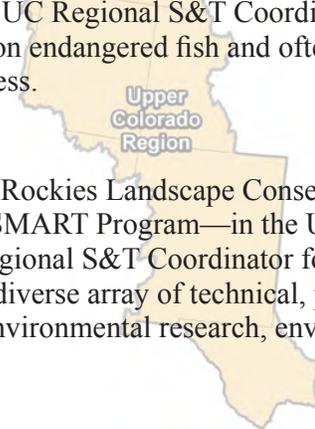
### Mark McKinstry

Mark McKinstry is a Biological Scientist in the UC Regional Office in Salt Lake City, Utah, who serves as Reclamation's manager for the annual monitoring and research conducted for the San Juan Recovery Implementation Program. Mark became involved in the S&T Program beginning in 2008 and then became the UC Regional S&T Coordinator. Mark spends considerable time conducting fieldwork on endangered fish and often brings a field-researcher's viewpoint to the S&T Program process.



### John Rice

John Rice is the Science Coordinator for the Southern Rockies Landscape Conservation Cooperative—a program within Reclamation's WaterSMART Program—in the UC Regional Office in Salt Lake City, Utah. John became the co-Regional S&T Coordinator for the UC Region in 2016. He brings to the S&T Program a diverse array of technical, project management, and supervisory experience in applied environmental research, environmental impact assessment, and ecosystem restoration.



## Great Plains (GP) Region

### Collins Balcombe

Collins Balcombe is the Supervisory Program Coordinator for the GP Region's Oklahoma-Texas Area Office in Austin, Texas. Collins' involvement with the S&T Program began in 2010, after initiating multiple S&T investigations in Texas to help improve advanced water treatment knowledge related to desalination and water reuse. In 2013, in recognition for his S&T contributions, Collins was appointed the GP Regional S&T Coordinator.

His S&T interests include ecosystem needs, as well as water conservation and water availability, in particular the treatment of impaired water sources for beneficial use.

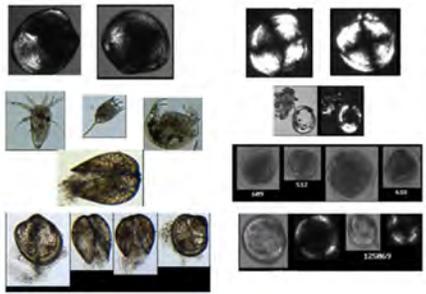
### Jennifer Beardsley

Jennifer (Jen) Beardsley is a Natural Resource Specialist in the GP Regional Office in Billings, Montana. Jen initially was involved in the S&T Program as the PN Regional S&T Coordinator from 2004 to 2006. In 2016, Jen returned to the S&T Program as the co-Regional S&T Coordinator for the GP Region. Regional S&T interests include all the research categories with specific needs in areas of climate change, invasive species, aging infrastructure, and stretching waters supplies through conservation or reuse.



# Research Bulletins

The following list of Research Bulletins showcase completed research within Reclamation's Science and Technology Program. Please contact the principal investigators for more information about these final research projects.



Project ID 2387

## Detecting Environmental Impacts of Invasive Mussel Infestations

*Developing an algae and zooplankton database using FlowCam™ technology*

“This technology has the potential for helping managers understand invasive mussel impacts on reservoirs.”

Denise Hosler, Botanist | Reclamation's Technical Service Center  
[www.usbr.gov/research/projects/detail.cfm?id=2387](http://www.usbr.gov/research/projects/detail.cfm?id=2387)



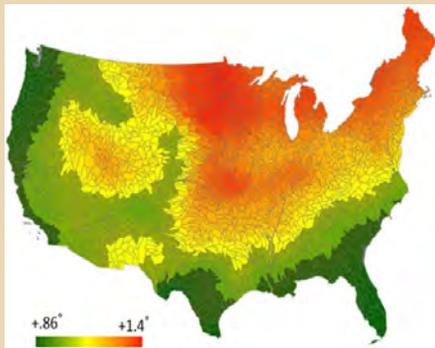
Project ID 1596

## Riparian Vegetation: Reclamation's Ally in River Restoration

*Developing tools to improve riparian vegetation management*

“Riparian vegetation is our primary ally in building successful river restoration projects. It never takes a day off.”

Blaire Greimann, Hydraulic Engineer | Reclamation's Technical Service Center  
[www.usbr.gov/research/projects/detail.cfm?id=1596](http://www.usbr.gov/research/projects/detail.cfm?id=1596)



Project ID 9449

## Making Sense of Global Climate Projection Data

*Geospatial and statistical analysis tools to aid scientists and engineers to access, visualize, evaluate, and use global climate projection data to inform water resources planning and design*

“Things become clearer when you can visualize complex data. Tools that can take a bunch of seemingly unrelated data files and turn them into a picture showing how they relate is invaluable.”

Gregory Gault, BORGIS System Manager/Architect | Reclamation's Pacific Northwest Region  
[www.usbr.gov/research/projects/detail.cfm?id=9449](http://www.usbr.gov/research/projects/detail.cfm?id=9449)



Project ID 7876

## Using Tablet Computers for Field and Laboratory Work

*Mobile Information Collection Application (MICA)—a versatile tablet app for real-time, location specific collection of field data, photographs, and notes*

“MICA was extremely easy to learn and use for field testing of cathodic protection systems. The absence of entering data from handwritten notes saved time and allowed us to see the information on a map for future use.”

Daryl Little, Materials Engineer | Reclamation's Technical Service Center  
[www.usbr.gov/research/projects/detail.cfm?id=7876](http://www.usbr.gov/research/projects/detail.cfm?id=7876)



# About the Knowledge Stream

**T**he *Knowledge Stream*, published by the Bureau of Reclamation’s Research and Development Office, is a seasonal magazine bringing mission-critical news about the agency’s research and science, as well as the many challenges associated with managing water and generating power in the West, including: projects, tools, methods, practices, results, innovation, prize competitions, publications, and more.

## Regional Science and Technology Coordinators Contact Information

Whether you are a regional researcher, Reclamation partner or customer, or just have an idea for a project that can help your region, the Regional Science and Technology Coordinators can help you with your research ideas, proposals, and projects.

Region	Coordinators	Email	Telephone
Pacific Northwest	Jennifer M. Johnson Jennifer Cuhaciyán	<a href="mailto:jmjohnson@usbr.gov">jmjohnson@usbr.gov</a> <a href="mailto:jcuhaciyán@usbr.gov">jcuhaciyán@usbr.gov</a>	208-378-5225 208-378-5271
Mid-Pacific	Jobaid Kabir Rod Wittler*	<a href="mailto:jkabir@usbr.gov">jkabir@usbr.gov</a> <a href="mailto:rjwittler@usbr.gov">rjwittler@usbr.gov</a>	916-978-5091 530-262-3670
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Great Plains	Collins Balcombe Jennifer Beardsley	<a href="mailto:cbalcombe@usbr.gov">cbalcombe@usbr.gov</a> <a href="mailto:jbeardsley@usbr.gov">jbeardsley@usbr.gov</a>	512-899-4162 406-247-7722

*\*Rod Wittler is also the Mid-Pacific Region Science Liaison.*

### On the Covers—

- Front Cover: Hoover Dam, Arizona/Nevada—Lower Colorado Region
- Back Cover: Glen Canyon Dam, Arizona—Upper Colorado Region (top left)
- Mt. Elbert Powerplant, Colorado—Great Plains Region (top right)
- Grand Coulee Dam, Washington—Pacific Northwest Region (bottom left)
- Shasta Dam, California—Mid-Pacific Region (bottom right)

