

The Knowledge Stream 2014 Review, 2015 Preview, and Research Awards

David Raff, Reclamation
Science Advisor and
Scientific Integrity Officer



[Former] Reclamation Commissioner Michael L. Connor named David Raff, Ph.D., P.E., D.WRE, as Reclamation's Science Advisor. In this position, Dave will serve as Scientific Integrity Officer—ensuring that the agency follows the U.S. Department of the Interior's Scientific and Scholarly Integrity Policy, while overseeing Reclamation's Research and Development Office.

In announcing Dave's selection, [former] Commissioner Connor stated, "Science and the scientific process are important at Reclamation. Dave's experience and understanding of climate change and its influences on hydrology will be a great benefit as Reclamation and its partners confront widening imbalances between water supply and demand throughout the West."

—continued on pages 12 and 13.

Science Advisor's Message

Fiscal year 2014 was a year of accomplishment for scientific goals and activities within Reclamation. We continue to provide critical science in such areas as water supply, advanced water treatment, renewable energy, infrastructure resiliency, and invasive species, to name just a few. The Research and Development Office (Research Office) is going through a period of change since the retirement of Curt Brown, Chief of Research and Development, who provided over 35 years of Federal service. His experience and leadership will be impossible to replace.

Moving forward, we will continue working towards ensuring that both our Science and Technology Program and Desalination and Water Purification Research Program provide the information and knowledge that best serve Reclamation and its customers and stakeholders. I am deeply excited about future opportunities within the Research Office to serve the broad community in meeting water and power needs in the Western United States in an environmentally sustainable manner.

In FY 2015, our Science and Technology Program is funding 131 research projects for \$9.2 million with a total non-Federal cost share of approximately \$3.8 million (see page 14). In addition, our Desalination and Water Purification Research Program is funding nine research projects and pilot studies at \$1.4 million, with an even larger non-Federal cost share of over \$6 million (see page 28). In this way, Reclamation actively leverages our limited research dollars as part of a much larger effort to develop collaborative and cost-effective water and power solutions with the private sector, non-profit organizations, and academia.

In addition to our ongoing annual research awards and activities, we will be undertaking several innovative efforts, including launching several water and power solutions challenge competitions (see page 10) and updating our scientific integrity and peer review policies (see page 12).

Dave Raff, Reclamation Science Advisor



*The FY 2015 Science and Technology Program Review Committee—
Front Row Left to Right: Genevieve Johnson, Desert Landscape Conservation Cooperative; Jennifer Johnson, Pacific Northwest Region; Yuliana Porras-Mendoza, Research Office; Lisa Krosley, Dam Safety Office; and Erin Foraker, Research Office.
Middle Row: Collins Balcombe, Great Plains Region; Rod Wittler, Mid-Pacific Region (MP Region)/ Research Office; Miguel Rocha, Research Office; Nathaniel Gee, Lower Colorado Region; Jobaid Kabir, MP Region; Travis Bauer, Technical Service Center; and Curt Brown, Research Office.
Back Row: Darrel Krause, Office of Policy; David Speas, Upper Colorado Region; Jake Akervik, Research Office; and Chuck Hennig, Research Office.*

About *The Knowledge Stream* . . .

The Knowledge Stream is the Bureau of Reclamation's Research and Development Office's quarterly newsletter bringing you news and information on Reclamation research and science: projects, events, innovation, results, publications, and more.

Help Us Write *The Knowledge Stream*: Send Us Your Content and Ideas

We welcome and encourage content from our readers. Please send your Recent and Upcoming Events, Innovation Around Reclamation, or any other content ideas to: research@usbr.gov.

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	Coordinator	Email	Telephone
Pacific Northwest (PN)	Jennifer M. Johnson	jmjohnson@usbr.gov	208-378-5225
Mid-Pacific (MP)	Jobaid Kabir	jkabir@usbr.gov	916-978-5091
Lower Colorado (LC)	Nathaniel Gee	ngee@usbr.gov	702-293-8029
Upper Colorado (UC)	Mark McKinstry	mmckinstry@usbr.gov	801-524-3835
Great Plains (GP)	Collins Balcombe	cbalcombe@usbr.gov	512-899-4162

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1. Print individual Research Updates on one sheet of paper, double-sided.
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3. For magazine-style, instruct your print professional to print the whole document double-sided, head-to-head, saddle-stitched on 11- x 17-inch paper.

Your suggestions for improvements are always welcome. Please email them to jakervik@usbr.gov.

Thanks,

Jake Akervik, Communication and Information Systems Coordinator
Research and Development Office

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Research and Development Office Contact Information

Website:

www.usbr.gov/research

Address:

PO Box 25007

Building 56, Room 1017

Denver Federal Center

Denver, Colorado 80225-0007

303-445-2125, research@usbr.gov

Dave Raff

Reclamation Science Advisor

202-513-0516, draff@usbr.gov

Levi Brekke

Chief of Research

303-445-2494, lbrekke@usbr.gov

Chuck Hennig

Deputy Chief of Research

303-445-2134, chennig@usbr.gov

Miguel Rocha

Science and Technology

Program Manager

303-445-2841, mrocha@usbr.gov

Jake Akervik

Communication and

Information Systems Coordinator

303-445-2136, jakervik@usbr.gov

Janet Montano

Administrative Assistant

303-445-2133, jmontano@usbr.gov

Research Coordinators

Yuliana Porras-Mendoza

Advanced Water Treatment

303-445-2265,

yporrasmendoza@usbr.gov

Erin Foraker

Renewable Energy

303-445-3635, eforaker@usbr.gov

Joe Kubitschek

Invasive Mussels

303-445-2148, jkubitschek@usbr.gov

Samantha Zhang

Technology Transfer

303-445-2126, szhang@usbr.gov

Rod Wittler

Mid-Pacific Region Science Liaison

530-262-3670, rjwittler@usbr.gov



U.S. Department of the Interior
Bureau of Reclamation

Reclamation's Searchable
Telephone Directory:
www.usbr.gov/phonebook

Recent and Upcoming Events



Bumping Lake Dam, Yakima Field Office

The list of events below is intended for informational purposes only and does not necessarily constitute an endorsement by Reclamation. These events may be of interest to the science, research, and related communities and are not necessarily hosted by Reclamation. A list of recent and upcoming events can also be found at: www.usbr.gov/research/events.

Reclamation's Pacific Northwest Regional Office—Annual Classroom Dam Operator Training

December 2 and 3, 2014 | Yakima, Washington

Reclamation's Directives and Standards for the "Operating Practices and Procedures for High-and Significant-Hazard Dams" (FAC 02-01), finalized on March 31, 2005, mandates that all primary and alternate dam operators responsible for the operations and maintenance of high-and significant-hazard dams within Reclamation's jurisdiction attend "Classroom Dam Operator Training" every 3 years.

This year's training included presentations regarding: safety and hazardous materials; lessons from dam failures/performance monitoring and failure modes; monitoring and instrumentation; dam inspection/testing and maintenance of mechanical equipment; standard operating procedures and record keeping; physical security; recognizing and reporting surveillance activities/terrorism trends; and emergency action plans/incident command system. Contact and additional training information:

Suzanne Marinelli, 208-378-5204, smarinelli@usbr.gov
www.usbr.gov/pn/programs/facilities

Renewable Energy World Conference & Expo North America 2014 Conference

December 9 - 11, 2014 | Orlando, Florida

With an unwavering history, the Renewable Energy World Conference & Expo North America is returning for its ninth year and will provide the perfect venue to gather and exchange information about the latest in technology, opportunities, and funding in today's changing world. The conference and expo will also, once again, be co-located with Power Generation Week, providing networking opportunities with more than 20,000 professionals and key decisionmakers.

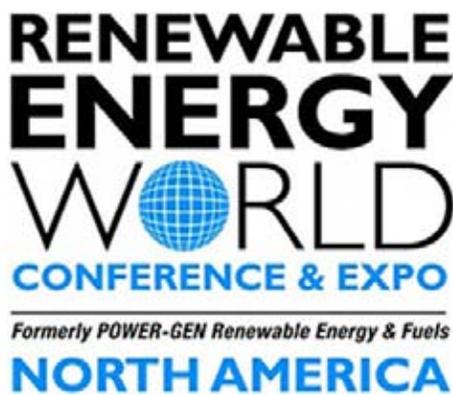
The Renewable Energy World Conference & Expo North America is recognized as the leading platform for information exchange, networking opportunities, and new business development covering all sectors in renewable energy and hot topics such as large-scale renewables, distributed generation, utility integration, renewables and the global market, and innovative energy partnerships. Additional conference and exhibition information: www.renewableenergyworld-events.com/index.html

Brazos River Demonstration Wetland—Groundbreaking Ceremony

January 27, 2015 | Waco, Texas

Can wetlands help treat unusable wastewaters and convert them into new usable water supplies? Reclamation's Science and Technology Program and the Oklahoma-Texas Area Office are partnering with the Texas Water Development Board; the City of Waco, Texas; the U.S. Geological Survey; and Baylor University to help research this question with a focus on evaluating how constructed wetlands may be able to reduce or remove endocrine disrupting compounds from treated wastewater effluent prior to recycling for potable drinking purposes. The City of Waco began construction of the experimental wetland, located in Waco along the Brazos River, with a groundbreaking ceremony on January 27, 2015. U.S. Department of the Interior officials and many others were invited to this kickoff ceremony.

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Following construction, the wetland will be planted with vegetation and undergo a series of hydraulic testing before declaring it ready for baseline monitoring later this year. Researchers will then follow a meticulous 3-year monitoring scheme to test a variety of hydrological, chemical, and biological parameters. Initial findings are expected in 2018. If successful, this project could signify an important advancement in making potable water reuse a more viable strategy to increase our Nation's usable water supplies, while also reducing the costly energy requirement and associated carbon footprint of using advanced water treatment technologies such as reverse osmosis. Contact and additional ceremony information: Collins Balcombe, 512-899-4162, cbalcombe@usbr.gov

Corrosion and Protective Coatings—Hands-On Training

February 10 through 12, 2015 | Denver, Colorado

The Materials Engineering and Research Laboratory in Reclamation's Technical Service Center presented a 3-day training course that familiarized participants with the issues relating to corrosion of metal and corrosion protection. Discussions included: how corrosion occurs and methods to minimize and prevent corrosion to Reclamation's infrastructure; protective coatings; cathodic protection; new technologies; and inspection and repair techniques relating to maintenance and repair of infrastructure. The course also discussed methods to control zebra and quagga mussels, with emphasis on the foul-release coatings control method.

The training course was intended for engineers, technicians, specifications writers, technical project managers, and other staff associated with construction and repair of water resources structures. Contact and additional training information: Allen Skaja, 303-445-2396, askaja@usbr.gov

The Northwest Hydroelectric Association (NWHHA)—Annual Conference and Technical and Operations Seminar

NWHA provides a regional voice for the hydropower industry, representing the needs of its membership since 1981. NWHA is dedicated to the promotion of the region's waterpower as a clean efficient energy, while protecting the fisheries and environmental quality that characterize the Northwest Region.

The NWHHA technical workshops and seminars offer the engineers, electricians, mechanics, operators, and technicians servicing the hydroelectric industry a forum to discuss and learn about the arts and issues of their work, which is fundamental to the Northwest Region quality of life.

2015 Annual Conference

February 17 - 19, 2015 | Portland, Oregon

See www.nwhydro.org/events_committees/AnnualConference.htm

2015 Technical & Operations Seminar—Machines, Maintenance, and Management: Keeping Hydro Facilities Up and Running

May 7 - 8, 2015 | Hood River, Oregon

See www.nwhydro.org/events_committees/tech_operations_conference.htm

Additional NWHHA information: www.nwhydro.org/default.htm



Effect of thin seal: Aluminum/Al₂O₃ systems tested in the BOR cycle after 5,040 hours. (a) Amercoat seal, (b) Metco, (c) unsealed.



Multimedia Around Reclamation

Challenge.gov Celebrates 4 Years

As of September 2014, Challenge.gov is celebrating their 4th birthday!

“It doesn’t take a genius to come up with a great idea; it just takes a bunch of people with motivation, passion, and creative ideas. . . and hard work.”

Published on January 20, 2015. See:

Video: <https://www.youtube.com/watch?v=YryUpIWQDR0>

More Information: See the “Technology Challenges” segment in this issue.

Reclamation Laboratories Working With Worldwide Customers

The Materials Engineering and Research Laboratory (MERL) in Reclamation’s Technical Service Center is sharing its knowledge, experience, and capability in evaluating material from large dams. There really is not anywhere else in the world that can provide these services.

Since its inception, Reclamation has been active internationally. It has long made available its expertise in water resources through specially designed reimbursable technical assistance and training programs. Programs may entail the assignment of Reclamation experts overseas on long-term details (usually 2 years), on a short-term basis, or a combination of both. Each technical assistance program is designed to address the specific needs of the requesting agency, and technology transfer and capacity building are routinely integrated into each program. All costs associated with technical assistance programs are fully reimbursable to Reclamation.

MERL occupies 3½ acres of Building 56 on the Denver Federal Center (Colorado), one of Reclamation’s research facilities. MERL has the resources to test concrete, concrete reinforcement, selected metals, plastics, geotextiles, coatings, and other materials. Tests include physical properties, corrosion, durability, environmental, and drying and shrinkage.

Published on December 19, 2014. See:

Video: www.youtube.com/watch?v=R0Dos6UEiI0

More Information on MERL: www.usbr.gov/pmts/materials_lab/

Quagga Mussel Research—Six-Year Report, October 2014

Reclamation has released a report titled, *Coatings for Mussel Control—Results From Six Years of Field Testing*, which summarizes 6 years of testing coatings to control the attachment of quagga and zebra mussels to water and power facilities. Since the study began in 2008, Reclamation has tested more than 100 coatings and materials.

The testing was conducted at Parker Dam (Arizona/California) on the Colorado River. Invasive mussels at this location reproduce year-round and have a high growth rate. Each coatings system was tested in static and flowing water conditions at the dam and evaluated twice annually, in May and November.

The research was funded by the Research and Development Office where research is conducted to develop and deploy successful solutions to improve water management practices, increase water supply, and ensure cost-effective power generation operations.

Published on October 21, 2014. See:

Video: <https://www.youtube.com/watch?v=jIoflXY9zy8>

Report: <http://www.usbr.gov/mussels/>

More Information: See the “Invasive Mussels” and “Research Spotlight—Coatings” segments in this issue.



Featured Faces

In this issue the Regional Science and Technology (S&T) Coordinators are presented. There are five coordinators, one in each Reclamation region. The coordinators help support regional participation in Reclamation's S&T Program by:

- Encouraging interest and participation in Reclamation's S&T Program
- Developing relationships with regional researchers
- Supporting proposal development
- Keeping the region informed of activities in Reclamation's S&T Program
- Assigning reviewers from the region to review proposals for relevancy
- Identifying regional research needs
- Participating in the Annual Program Review Meeting
- Supporting technology transfer efforts

Contacting the coordinators to discuss innovative ideas and research is encouraged (see page 2 for contact information).

Jennifer Johnson, B.S., M.S.

Jennifer Johnson has been the Regional S&T Coordinator for the Pacific Northwest (PN) Region since 2009. She has worked with Reclamation for 11 years as a hydraulic engineer, where she develops and runs water resource and groundwater computer simulation models. Jennifer holds a bachelor's degree in both civil engineering and geophysics, a master's degree in civil engineering, and is currently working on a Ph.D. in water resource management.

In 2007, Jennifer began working on S&T projects and applying for S&T grants. As the Regional S&T Coordinator for the PN Region, she assists with proposal writing, coordinates research projects that are the priority of the PN Regional Director, and helps facilitate communication between researchers in the PN Region and the Research and Development Office. Recently, Jennifer worked with the Mid-Pacific Region to begin developing cross regional research project teams that work to solve problems in multiple regions simultaneously.

Jobaid Kabir, Ph.D., P.E.

Jobaid Kabir is Chief of the Decision Analysis Branch in Reclamation's Mid-Pacific (MP) Region in Sacramento, California. Jobaid holds a bachelor's degree in civil engineering and a master's degree in water resources engineering from the Bangladesh University of Engineering and Technology. In addition, he holds a master's degree in civil and environmental engineering and a doctorate in engineering from Washington State University. Jobaid has more than 30 years of experience in water resources planning and management, environmental and ecosystem management, program management, and various fields in hydraulics and hydrology.

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Jennifer Johnson,
PN Regional S&T Coordinator.



Jobaid Kabir,
MP Regional S&T Coordinator.



Featured Faces



Nathaniel Gee,
LC Regional S&T Coordinator.



Nathaniel Gee inspecting the Nevada Spillway at Hoover Dam.

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Jobaid became involved in Reclamation's S&T Program shortly after joining Reclamation in 2010 and began serving as the Regional S&T Coordinator for the MP Region soon afterward. He supports Reclamation's S&T Program by reviewing and evaluating research proposals, encouraging MP Region staff to submit proposals for funding, working with other regional coordinators to develop multi-regional proposals for Reclamation, and designing and implementing the Water and Power Solutions Technology Challenges Program. Some of Jobaid's recent accomplishments include coordinating development of multi-regional proposals on methyl mercury modeling for reservoirs and fire impacts on reservoirs for fiscal year (FY) 2015. In addition, he coordinated the development of a fish barrier proposal for the MP Regional Director in FY 2014. Jobaid is currently working to coordinate similar proposals for FY 2016.

Nathaniel Gee, B.S., M.S., P.E.

Nathaniel Gee works in the Examination of Existing Structures Group of the Engineering Services Office in Reclamation's Lower Colorado (LC) Region. He received his bachelor's degree in civil engineering from Brigham Young University and his master's degree in civil engineering from the University of Nevada-Las Vegas. Nathaniel has worked for Reclamation for 5 years.

Nathaniel was delighted to accept the opportunity to become the Regional S&T Coordinator for the LC Region and has served in this position for 1 year. Recently, he became involved for the first time in finding relevancy reviewers and reviewing S&T proposals. Nathaniel enjoys being part of the process and assisting regional employees in gathering proposals for projects that will help further Reclamation's mission.

In addition to S&T work, Nathaniel conducts inspections of dams, pumping plants, and other infrastructure. He particularly enjoys rope and dive inspections. Nathaniel has been a member of the LC Region's rope access and dive teams for the past 3 years. When he is not swimming and repelling near and off of dams, Nathaniel enjoys chasing his five children at home.

Mark McKinstry, B.S., M.S., Ph.D.

Mark McKinstry works in Reclamation's Upper Colorado (UC) Region and has been a biological scientist for 11 years. Prior to joining Reclamation, Mark was a senior research scientist at the University of Wyoming, where he directed a group of staff working on aquatic habitat and wildlife projects throughout the Western United States. Mark has a bachelor's degree in wildlife biology, a master's degree in zoology and water resources, and a doctorate in zoology and physiology, with an emphasis in statistics.

Mark currently serves as Reclamation's manager for the annual monitoring and research conducted for the San Juan Recovery Implementation Program. He also assists with other projects; notably, installing and using Passive Integrated Transponder (PIT) tag systems for detecting fish.

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. . .Highlighting People That Contribute to Reclamation Research

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Mark became involved in Reclamation's S&T Program in 2008 and now serves as the Regional S&T Coordinator for the UC Region. He spends considerable time conducting field work on endangered fish and often brings a field researcher's viewpoint to the S&T process. Mark's duties as the Regional S&T Coordinator consist primarily of identifying people to serve as reviewers for proposals and finding people who can develop and submit good proposals. The process of evaluating and ranking proposals each year is often one of Mark's highlights because he gets to see the wide range of projects that Reclamation works on, from dam construction to endangered species research and management.

Some S&T projects Mark has been involved with include developing and using a floating PIT tag antenna system that is now commercially marketed, evaluating the effects from removal of nonnative fish, and using PIT tag antenna systems to quantify the entrainment of fish in diversions. For all of these projects, he brings together a diverse group of field researchers, academics, managers, and graduate students. Mark often serves on graduate student committees and frequently describes his job as "the best job in Reclamation!"

Collins Balcombe, B.A., M.S.

Collins Balcombe is the Supervisory Program Coordinator for Reclamation's Oklahoma-Texas Area Office (OTAO) in Austin, Texas. He has a bachelor's degree in zoology from the University of Texas–Austin, as well as a master's degree in wildlife and fisheries from West Virginia University. He has been with Reclamation since 2003.

Collins' involvement with Reclamation's S&T Program began in 2010, with a focus on advanced water treatment (AWT), a hotbed topic in Texas, where desalination and water reuse are becoming prevalent, drought proof solutions to meet water needs. In addition to demands for water, there is a continuing need to improve technology and lower the costs of AWT. Reclamation's S&T Program has provided OTAO with the vehicle to coordinate with non-Federal partners and use Reclamation's expertise to address these needs.

Through Reclamation's S&T Program, OTAO combines proper oversight/management with the following step-wise process, which results in exceptional value with relatively minimal financial investment: 1) build trust with Reclamation's partners; 2) solicit good research ideas that have real-world applications; 3) convene teams of highly capable Reclamation staff (usually from Reclamation's Technical Service Center [TSC]) to submit joint proposals, which also fund TSC's involvement; 4) leverage S&T funding commitments with OTAO's in-kind assistance to manage projects, as well as in-kind support from stakeholders; 5) accomplish the work; and 6) disseminate results.

As the Regional S&T Coordinator for the Great Plains Region, Collins plans to expand this process, serving as an advocate to advance the needs and interests of the region as a whole, whether by brainstorming ideas or helping craft research proposals that maximize success.



Mark McKinstry, UC Regional S&T Coordinator, conducting field work on the Pecos River in Texas. He is shown wearing a personal floatation device (pfd), which is often his "uniform" while working on rivers of the Southwest.



Collins Balcombe, GP Regional S&T Coordinator, conserving water using an innovative rainwater harvesting technique.



Technology Challenges

More Information

Learn more about prize competitions and the Research and Development Office's (Research Office) Water Prize Competition Center at:

<http://www.usbr.gov/research/challenges/>

Research Office's Future Fish Recovery Prize Competitions

Collaborating with many agencies, Reclamation is working to develop fish recovery challenge competitions to:

- Help threatened and endangered fish negotiate dams
- Improve ways to track and monitor fish throughout annual migration and life cycles
- Protect threatened, endangered, and other sensitive species
- Improve habitat conditions for targeted species



Razorback suckers feeding.

Water Prize Competition Center

Fish Recovery Prize Competitions—Ensuring Wins for Water and Fish

The Prize Competition Authorities included in the America COMPETES Reauthorization Act of 2010 provides an “open-government” tool that enables Federal agencies to engage the American public and private sectors to help solve problems confronting their agency. Federal agencies can now define a specific problem, the performance specifications that a winning solution would have to demonstrate, challenge the entire public and private sectors to deliver the winning solution, and then award a cash prize to the winner(s). Cash awards are only issued if a winning solution is obtained.

In Fiscal year (FY) 2014, the Office of Management and Budget added, and the Congress appropriated, \$2 million to Reclamation's Science and Technology Program to undertake technology challenges as a new tool for solving problems that confront Reclamation's mission of managing water and related resources in the West. The President's budget request for FY 2016 includes an additional \$3 million to continue the program.



Participants in the October 2014 Fish Recovery Prize Competitions Training and Kickoff Meeting.

The Research and Development Office (Research Office) has been busy securing a contract that provides prize competition design and launching services, and establishing multiagency Federal collaborations for its Water Prize Competition Center that is focused on three thematic areas:

1. Water Availability
2. Ecosystem Restoration
3. Infrastructure Sustainability

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The intent is to have agencies that share a common stake in these problems team up to design and launch specific prize competitions. Federal collaboration enables agencies to leverage Federal capabilities, catalyze interagency working relationships, better define and solve joint problems, avoid duplication, and find solutions that have a broader impact across the mission of multiple Federal agencies, the stakeholders Reclamation collectively serves, and overall public good. The Ecosystem Restoration Challenge Team consists of program managers and technical specialists from Reclamation, U.S. Fish and Wildlife Service, U.S. Geological Survey (USGS), U.S. Corps of Engineers (USACE), and the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service. This team participated in a prize competition training and kickoff meeting in October 2014 (see photograph). The training was provided by Reclamation's prize competition design and launch services contractor, Innocentive.com. All prize competitions launched by the Research Office's Water Prize Competition Center will be posted on Challenge.gov and the Innocentive.com Challenge Center. The Research Office anticipates its initial prize competition, which will likely seek new ways to identify and track fish for endangered fish recovery programs, will be launched sometime during spring 2015.

The Research Office is currently in the process of building its multiagency prize competition collaborations for the Water Availability and Infrastructure Sustainability theme areas. Under Water Availability, discussions are being held with USGS, USACE, NOAA, U.S. Department of Agriculture, U.S. Environmental Protection Agency, National Aeronautics and Space Administration, and the National Institute of Standards and Technology (NIST) to join Reclamation's collaboration and participate in the training and kickoff meeting scheduled for May 2015. Under Infrastructure Sustainability, discussions are being held with USACE and NIST to form the core of a multiagency collaboration and participate in the training and kickoff meeting scheduled for July 2015.

Why Challenge?

The Government's advantages for issuing challenges are clear: This is a low-risk way to find more successful approaches to very complex and interrelated problems. For participants, challenges offer opportunities to showcase new ideas and be heard, participate on levels not possible through traditional channels, and win some money.

The Types of Problems Better Suited for Prize Competitions

1. An adequate or strong solution has been evasive or expensive.
2. You find yourself saying that somebody, somewhere probably knows a better way of doing this.
3. Market forces may not provide appropriate incentives to solve...or solve well.
4. You would like to reach beyond the usual sources of potential solvers and experts that commonly work in your domain.

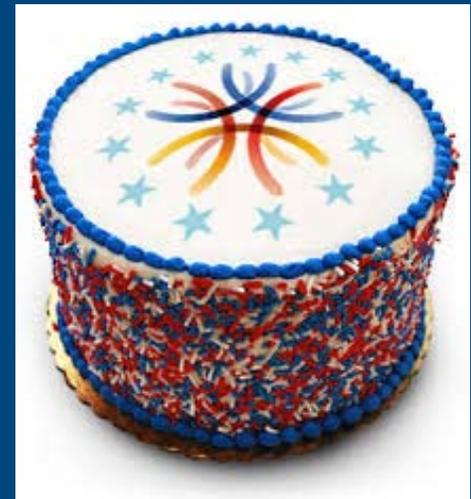
“We hope that prize competitions can help Reclamation solve some of the biggest challenges in the area of fish recovery.”

Connie Svoboda
Hydraulic Engineer, Reclamation's
Technical Service Center

Challenge.gov's Birthday

As of September 2014, Challenge.gov is celebrating their 4th birthday!

See the “Multimedia Around Reclamation” segment in this issue for a video regarding Challenge.gov and celebrating 4 years of challenges.



Challenge.gov's 1st birthday.
Source: <http://blog.challengepost.com/post/9936107955/happy-1st-birthday-challenge-gov>

Research Office Contact

Chuck Hennig
Deputy Chief of Research
303-445-2134
chennig@usbr.gov



Reclamation Science Advisor

Reclamation Science Advisor and Scientific Integrity Officer



Dave Raff
202-513-0516
draff@usbr.gov

More Information—Scientific Integrity and Peer Review

U.S. Department of Interior's
Integrity of Scientific and Scholarly
Activities (Internet Site):

[www.doi.gov/scientificintegrity/
index.cfm](http://www.doi.gov/scientificintegrity/index.cfm)

U.S. Department of Interior's
Departmental Manual (305 DM 3):

[http://elips.doi.gov/elips/0/doc/3045/
Page1.aspx](http://elips.doi.gov/elips/0/doc/3045/Page1.aspx)

Reclamation Manual
(Policy CMP P13):

[www.usbr.gov/recman/cmp/
cmp-p13.pdf](http://www.usbr.gov/recman/cmp/cmp-p13.pdf)

Science Advisor Priorities

Scientific Integrity and Peer Review

Reclamation's water and power delivery needs to be informed by the best available science. Reclamation's research and scientific analyses that inform decisions need to be transparent, well documented, and subjected to peer review. Peer reviews examine data sources, assumptions, and methods to ensure that this is good science. The peer review process gives researchers and analysts the opportunity to draw on the experience of others and to get other perspectives, which help ensure high quality work.

“By helping to ensure a positive culture of scientific integrity, we are maintaining and encouraging an environment of rigorous and honest investigation, open discussion, and constructive peer review, free of political influence that is needed for good science to thrive.”

U.S. Department of the Interior's
Scientific Integrity Policy Frequently Asked Questions:
www.doi.gov/scientificintegrity/FAQ.cfm

Training

Giving Reclamation practitioners access to the best available science in a timely and consistent manner through training and information services is as important as generating that knowledge. Reclamation will continue to identify the water manager needs in the Western United States (U.S.) and the appropriate methods to share information.

Research and Development Office Priorities

Challenges to managing water and power in the Western U.S. in an environmentally sustainable manner continue to grow—and research is key to developing the solutions needed to meet these challenges. Reclamation's research priorities include:

- Understanding and impacts of climate change on water resources and developing tools implement adaptation strategies
- Forecasting and monitoring water supplies
- Developing new sources of water through advanced water treatment and desalination
- Understanding and measuring the effectiveness of restoration activities
- Increasing the reliability of aging water infrastructure
- Mitigating the impacts of invasive zebra and quagga mussels on water and hydropower facilities
- Advancing renewable energy generation by Reclamation

“I want to make sure that Reclamation decisionmakers have access to the best available science. I also want to ensure that science is held to the highest standards of quality and scientific integrity. Those are the goals of my position.”

—Dave Raff



U.S. Department of the Interior
Bureau of Reclamation

David Raff, Science Advisor, Ph.D., P.E., D.WRE

David (Dave) Raff is Reclamation's Science Advisor and Scientific Integrity Officer. He was selected for this position in February 2014 by [former] Reclamation Commissioner Michael L. Connor, who named Dave as Reclamation's Science Advisor.

Dave has an expansive role as Science Advisor, with duties that range from overseeing Reclamation's Research and Development Office (Research Office) to ensuring that Reclamation adheres to the Scientific and Scholarly Integrity Policy set by the U.S. Department of the Interior. Dave has extensive experience in program management and has worked with numerous Federal multiagency committees, academia, and national organizations to help resolve complex issues involving hydrology, water management, and climate change. His depth of knowledge in these areas will help Reclamation continue to meet its mission of providing water and power in an environmentally sustainable manner in the 17 Western States.

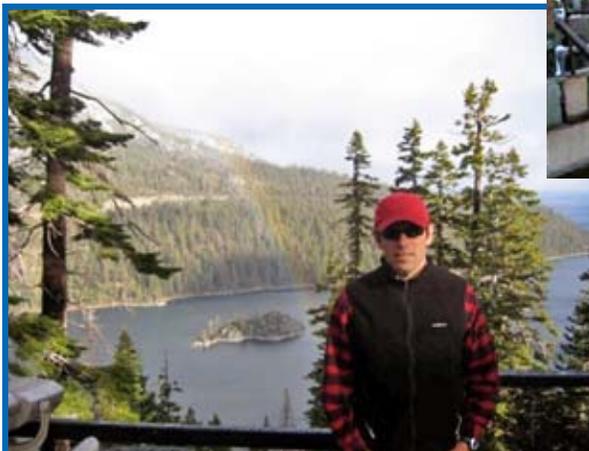
Dave was born in Silver Spring, Maryland, and attended Paint Branch High School. In 1997, he obtained his Bachelors of Science in Electrical Engineering from Tufts University, where he graduated Magna Cum Laude. In addition, he earned a Masters of Science in Rangeland Ecosystem Science in 1999, as well as a Doctor of Philosophy in Civil Engineering in 2002, from Colorado State University. Dave is a Registered Professional Engineer in the State of Colorado and a Diplomate of Water Resources Engineering in the American Academy of Water Resource Engineers. He has served as an adjunct faculty member at Colorado State University and Colorado School of Mines, has written many scholarly articles, and has made numerous presentations at conferences on statistical flood analysis, hydrology, and climate change impacts.

Dave worked with Reclamation from 2003 to 2011 as a civil engineer in the Technical Service Center's Flood Hydrology and Meteorology Group and a program analyst in the Program Management Office, respectively. In 2011, he supported the development of the first report to Congress, as required under Section 9503 of Public Law 111 11, the SECURE Water Act, which identified water management risks in Western U.S. basins with respect to the changing climate. While working at Reclamation, he received the U.S. Department of the Interior's Superior Service Award. In 2011, Dave joined the U.S. Army Corps of Engineers as a senior hydrologist and hydraulic engineer within the Institute for Water Resources. In that capacity, he collaborated with climate change communities to obtain information that could be applied to improve sustainable water resources management throughout the Nation.

Since his February 2014 selection as Reclamation's Science Advisor, Dave has provided leadership for the Research Office, while continuing to tackle complex hydrologic and climate change issues. He has been working with the National Center for Atmospheric Research to produce state-of-the-art hydrologic projection tools that can be adapted to changing climates, as well as collaborating with Federal interagency committees and the engineering community on issues of water availability and quality.

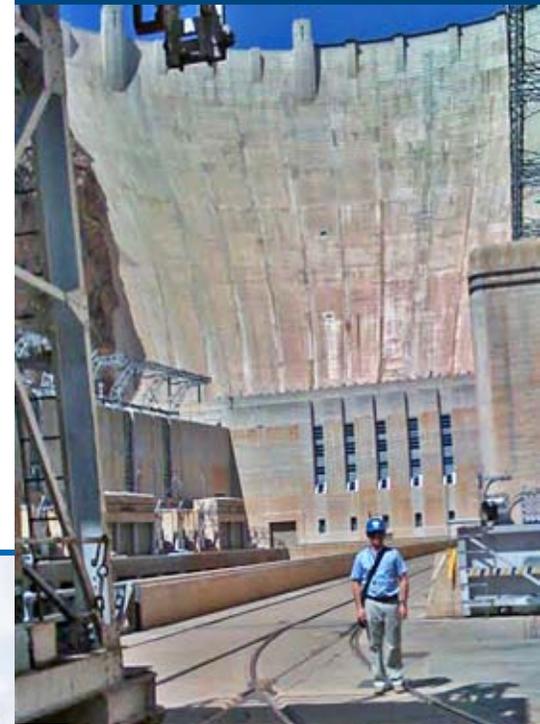
Dave spends his free time with his wife and two children and enjoys participating in outdoor activities as often as possible.

Dave Raff taking part in a hydrologic hazard investigation in Lake Tahoe, California.



"I would like to ensure that Reclamation practitioners have the scientific information that they need to make the most informed decisions possible. I would like to accomplish the generation of new knowledge through research and development and by connecting people with other communities that may already have access to knowledge."

**Dave Raff
Reclamation Science Advisor**



Dave Raff touring Hoover Dam (Nevada/Arizona) and its facilities.

More Information

February 10, 2014, News Release:
<http://on.doi.gov/1xc002f>



U.S. Department of the Interior
Bureau of Reclamation

FY 2015 Research Awards

FY 2014 Review and FY 2015 Preview

For fiscal year (FY) 2014, Reclamation's Science and Technology (S&T) Program awarded \$13,265,000 for 143 ongoing and new research projects, focusing on priority areas such as:

- Advanced Water Treatment
- Climate Change and Variability
- Invasive Zebra and Quagga Mussels
- Renewable Energy and Energy Conservation
- Water and Power Technology Solutions Challenges
- Pulse Pressure Technology (Mussels)
- Other Mission-Related Research

In addition, a new activity to Reclamation's S&T Program research portfolio included the "Regional Director's Science Issues Research Needs." This new area of research was directed at addressing science issues on the minds of Reclamation's premier water managers—its five Regional Directors.

Awards in FY 2015 will continue to focus on FY 2014 priority areas. In addition, FY 2015 will feature a new priority area activity, "Sustainable Water Infrastructure and Safety," which has traditionally been addressed as an S&T core area along with the other activities—Water Operations and Decision Support, Environmental Issues in Water Delivery and Management, and Conserving and Expanding Water Supplies.

Reclamation's Science and Technology Program Research Awards and Portfolio

Reclamation's Science and Technology (S&T) Program is managed by the Research and Development Office (Research Office), who reports to Reclamation's Science Advisor. The program is focused on providing innovative solutions for Reclamation water and facility managers and its western stakeholders. The program includes "competed" research submitted for consideration by Reclamation employees, and "directed" research is designed by Research Office staff and performed by both Reclamation employees and outside experts.

This fiscal year (FY), the Research Office has awarded 111 competitive and 20 directed projects. The competitive proposals are reviewed by a Reclamation team that includes representatives from all five Reclamation Regional Offices and Reclamation's Technical Service Center, Dam Safety Office, and Policy and Administration.

Thus, a total of 131 ongoing and new research projects have been or will be funded this FY. Technology transfer, collaboration, workshops, and other outreach efforts are also funded to help ensure our innovative ideas and solutions reach Reclamation managers; other Federal, state, local, tribal, and non-governmental entities; and the public.

The table below shows the complete spending plan for Reclamation's S&T Program. This table includes staff time, directed activities, and U.S. Department of the Interior assessments.

FY 2015 Science and Technology Program Research Portfolio Summary

Activity	Budget
Advanced Water Treatment	\$ 975,000
Climate Change and Variability	\$ 1,256,255
Invasive Zebra and Quagga Mussels	\$ 1,636,947
Renewable Energy and Energy Conservation	\$ 1,376,550
Regional Director Research Needs	\$ 691,434
Sustainable Water Infrastructure and Safety	\$ 1,343,900
Water Operations and Decision Support	\$ 685,980
Environmental Issues in Water Delivery and Management	\$ 956,550
Conserving and Expanding Water Supplies	\$ 322,500
Total	\$ 9,245,116

The Zebra and Quagga Mussel research amount includes carryover of \$1.1 million for research related to Pulse Pressure Technology to reduce mussel settlement.



Reclamation Regional Director Research Needs

In FY 2015, the Research Office is continuing to identify research that directly addresses science issues on the minds of Reclamation's premier water managers—its five Regional Directors. Reclamation's five Regional Directors were asked to identify issues that could benefit from research and development projects. A number of issues were submitted, and the Research Office worked with others to develop research proposals and to pull together a team to plan research for each of the identified science issues. The following are the research questions that will be examined over the next year:

Can undesirable water quality in reservoirs be improved by aeration and oxygenation of associated canals? What are the benefits to aquatic life?

Contact: Laura Harger | Great Plains Region | 970-962-4337 | lharger@usbr.gov

What methods are available to mitigate nitrosamines, a disinfectant byproduct, in Reclamation's rural water systems?

Contact: Stacy Froelich | Great Plains Region | 605-945-2980 x3004 | sfroelich@usbr.gov

How has the morphometry of the Las Vegas Wash (Nevada) changed since Reclamation carried out studies during the 1980s? The study will use the Las Vegas Wash as a demonstration site to investigate the use of dye tracing in conjunction with hydrodynamic modeling in support of river and habitat restorations.

Contact: Kevin L. Kelly | For Lower Colorado Region | 720-663-7944 | kkelly@usbr.gov

Can Reclamation find a commercially available software that can help manage projects, prepare standard project documents, and integrate with the new financial system? Thus, allowing fee-for-service offices the ability to quickly and accurately manage schedule and budget of ongoing projects.

Contact: Nathaniel Gee | Lower Colorado Region | 702-293-8029 | ngee@usbr.gov

What methods can be identified and used to detect canal seepage?

Contact: Nathaniel Gee | Lower Colorado Region | 702-293-8029 | ngee@usbr.gov

What is the effectiveness of a graduated field electrical fish barrier to reduce movement of adult fall-run Chinook salmon from the Mokelumne River, through the Delta Cross Channel Gates, and into the Sacramento River, California?

Contact: Zak Sutphin | For Mid-Pacific Region | 303-445-2141 | zsutphin@usbr.gov

What are the land subsidence impacts of groundwater pumping near the Delta-Mendota Canal?

Contact: Jobaid Kabir | Mid-Pacific Region | 916-978-5091 | jkabir@usbr.gov

Can meaningful aquatic ecosystem health indicators be developed that will allow Reclamation to effectively and affordably measure aquatic health? What are measures currently kept by Reclamation restoration programs and recovery projects?

Contact: David Gaeuman | Mid-Pacific Region | 530-623-1813 | dgaeuman@usbr.gov

Can Reclamation's Pacific Northwest Region gain an understanding of its current safety culture and determine the practices and protocols that are successful in other private and public organizations as well as ways to implement the successful practices and protocols within the Reclamation culture?

Contact: Lesa Stark | Pacific Northwest Region | 208-378-5114 | lstark@usbr.gov

In an effort to better prepare Reclamation employees before, during, and after a wildfire incident, can a learning module be developed to educate employees of their roles and responsibilities in performing wildland fire duties in a safe and fiscally responsible manner?

Contact: Chuck Dillon | Pacific Northwest Region | 208-378-5326 | cdillon@usbr.gov

Is the new innovative fish weir design, with its ability to reduce entrainment of fish in the Hogback Canal, producing the intended results?

Contact: Mark McKinstry | Upper Colorado Region | 801-524-3835 | mmckinstry@usbr.gov

Research and Development Office Science and Technology Program Manager

Miguel Rocha
303-445-2841
mrocha@usbr.gov

Miguel Rocha is the Science and Technology Program Manager for the Research and Development Office. In this position, he manages the selection process, develops policy, and coordinates over 100 research projects annually.

With over 16 years working for Reclamation, Miguel has developed broad water resource experience in water recycling, water operations, water conservation, civil design, and safety of dams. During this tenure he has worked in Oklahoma, Montana, New Mexico, Texas, and now Colorado.

Miguel is a graduate of New Mexico State University and is a Registered Professional Engineer in the State of New Mexico.

More Information

November 19, 2014, News Release:

www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=48148

Science and Technology Program
FY 2015 Awards Fact Sheet:

www.usbr.gov/research/docs/st-funding-fact-sheet-2014-nov-19.pdf

FY 2015 Science and Technology
Program Research Awards:

www.usbr.gov/research/docs/st-research-awards-fy-2015-list-2014-nov-19.pdf



Science & Technology Program

Water Operations and Decision Support Research Projects

This Reclamation Science and Technology Program research is focused on developing solutions and tools to help Reclamation water managers make effective reservoir and river system operational and planning decisions through better integration, evaluation, understanding, and presentation of critical data and information. Improvements and technological advances are pursued in managing hydrologic events, water supply forecasting, water operations models and decisions support systems, and water resource data analyses.

FY 2014 Highlights

Water Conflict Management

This research was designed to determine how best to manage disputes over science. Focus groups in Reclamation area offices indicated that one of the most prominent types of water conflict that occurs involves disagreements over science. For instance, one scientist's research indicates that an endangered aquatic species needs X amount of habitat to survive, and another indicates it needs Y. An electronic survey was conducted to determine what sorts of disputes over science occur and how they are best managed. Results indicated that these disputes occur in domains ranging from climate science to endangered species to invasive species to hazard analysis to design. In addition, they occur at every phase of the scientific enterprise: assumptions, data collection methods, classification scheme design, assignment of causes-to-effects (e.g., did Reclamation operation of the river aggravate or alleviate an endangered species recovery?), analyses, and inferences drawn from the science. Analysis of the electronic survey data indicated that collaborative processes show promise for effective management of disputes over science.

Contact: Douglas Clark | Reclamation's Technical Service Center
303-445-2271, drclark@usbr.gov

Unmanned Aerial Vehicle Community of Practice

This development effort was designed to explore how unmanned aerial systems (UAS) can help Reclamation accomplish its mission work "better, faster, and cheaper." There are currently over 90 members in the community of practice. They work collaboratively to keep each other informed about relevant laws and policies, emerging technologies, and potential applications. Some of the members also participate in U.S. Department of the Interior (DOI) efforts to conduct needs analyses, recommend technologies for adoption, and develop a departmental UAS roadmap. In a recent DOI survey, Reclamation responders indicated that UAS would be useful for a wide variety of applications. These included law enforcement surveillance, reservoir and canal surveys, encroachment detection, dam face surveys, search and rescue, fire suppression, topographic mapping, and vegetation surveys. It appears that UAS will be particularly suitable for frequent surveys over small, defined areas. Thus far, Reclamation staff has participated in two UAS missions (see: http://rmgsc.cr.usgs.gov/UAS/WA_BORRriverSedimentMonitoring.shtml). Other missions are being contemplated when legal requirements can be met.

Contact: Douglas Clark | Reclamation's Technical Service Center
303-445-2271, drclark@usbr.gov



Hand launch of the "Raven" unmanned aerial vehicle at Aldwell Reservoir on the Elwha River, Washington, in support of tracking sediment changes during dam removal.

Unmanned Aerial Vehicle Research of Lightweight Sensor Options

This research effort was designed to explore and test viable lightweight sensors and cameras that can be used onboard U.S. Department of the Interior (DOI) unmanned aerial systems (UAS). Coupling UAS emerging technologies with augmented lightweight sensors, the potential exists to assist Reclamation to accomplish its mission work “better, faster, and cheaper.” Research indicated options for natural color imagery, infrared imagery, multispectral/hyperspectral, thermal, and light detection and ranging (LiDAR) as having promising potential for future sensed data using UAS. With the limited UAS options available for use within DOI, this effort was focused on the research and testing of sensor and camera options that are suitable for DOI’s UAS inventory. Achieving high resolution imagery and maintaining data integrity from lightweight, onboard UAS sensors can provide cheaper data collection solutions for a wide variety of applications. These applications may include geomorphic studies, cultural and archeological surveys, law enforcement surveillance, hydrologic flows, reservoir and canal surveys, encroachment detection, dam face surveys, search and rescue, fire suppression, topographic mapping, and vegetation surveys.

Contact: Kristin Swoboda | Reclamation’s Pacific Northwest Region, 208-378-5244, kswoboda@usbr.gov

Real-Time Flow and Salt Load Visualization

Continuous flow and electrical conductivity (EC) monitoring stations are routinely installed in Reclamation’s San Luis service area (California) to be able to estimate watershed salt loading to the San Joaquin River. Also of importance are agricultural diversions that can remove salt load from the river (a portion of this salt load is delivered to the river through surface drainage conveyances and groundwater recharge). System modeling has been important in reconciling these inputs and outputs to the river; however, stakeholders found that running the model to retrieve input data and learning how the system operates was too onerous. Retrieving data from single stations one-at-a-time failed to provide a comprehensive view of relative flows and salt loads generated from different parts of the system. A simple geographic information system (GIS)-based visualization tool was needed by these stakeholders that provided an easy way to figure out the most important salt load contributors to the river and that allowed flow and salt loading trends over the previous 30 days to be reviewed as an aid to real-time salinity forecasting. An ArcGIS-based tool was developed that interrogates the California Data Exchange Center (CDEC) website and downloads 30 days of discharge and EC values for each river, drainage, and diversion station current in the sensor network. These data are then parsed and exported to a line-segmented map where each line segment represents that length of channel represented by the flow and EC data at the monitoring station. Calculations are made of salt load in units of tons per day and added as a selectable attribute in the map. The user toggles between flow, EC, and salt load—all of which use a color-ramp to display values. The user interface also has a graphical time series slider tool to march through daily values of all three parameters. Stakeholder evaluation and feedback will occur in the future based on continuing funding.

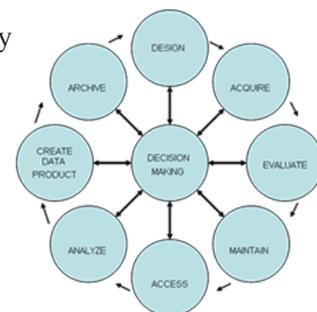
Contact: Jun Wang | Reclamation’s Mid-Pacific Region, 561-252-3855, junwang@usbr.gov

FY 2015 Initiatives

Data Stewardship

Reclamation assembled an interregional research team to investigate data stewardship processes in the agency with the prime focus on river restoration programs. The team learned that technology and collaboration are the primary predictors of successful data management. Other important factors included upper management support, data management expertise, holistic planning, and adequate funding. In the future, Reclamation will join U.S. Department of the Interior open data efforts and tailor agency policy to departmental requirements and recommendations. In addition, the team will actively support efforts to rationalize management of mission-critical data sets such as those pertaining to water, power, and endangered species. Finally, the team will make recommendations for data stewardship institutional arrangements within Reclamation.

Contact: Douglas Clark | Reclamation’s Technical Service Center, 303-445-2271, drclark@usbr.gov



Reclamation data life cycle.

Time Series Web Service

It is difficult to download Reclamation’s water data unless you know exactly where to look. Each region has different web pages, different access methods, and different formats of data. This research project will create a single web service for Reclamation river, reservoir, and AgriMet data. The website (<http://water.usbr.gov>) will be a dynamic website optimized for sharing data. Contact Karl Tarbet if you have a daily data set that you would like to include in this research.

Contact: Karl Tarbet | Reclamation’s Pacific Northwest Region, 208-378-5272, ktarbet@usbr.gov



Science & Technology Program

Conserving and Expanding Water Supplies Research Projects

This Reclamation Science and Technology Program research strives to develop solutions and tools that enhance water supplies for Reclamation stakeholders with new technologies, solutions, and practices that expand, liberate, or conserve water supplies. Improvements and technological advances are pursued in conjunctive groundwater storage and use, agriculture water efficiency, institutional approaches to water solutions, helping irrigation districts cope with change, reducing system water losses, and other conservation practices.

FY 2014 Highlights

Nuisance Aquatic Plant Control in Water Delivery Systems

The goal of this scoping project was to investigate strategies for controlling nuisance aquatic plants (NAP) in canals. The thought was that by understanding canal characteristics and local environmental factors promoting or conversely discouraging the growth of NAP, comprehensive solutions could be identified and implemented to reduce the need for chemical herbicides. Reclamation found that several such studies had been conducted, with no conclusive management recommendations able to be made. Additionally, Reclamation found that the primary need for the majority of managers consulted was how to make chemical herbicide applications more efficient. Out of these findings, a 3-year study was proposed that would focus on understanding the life history of NAP and develop methods for mapping vegetative biomass. This information would then be applied in scheduling treatment for optimal time and location, thereby reducing the amount of herbicide used and dead plant material that must be mechanically/physically removed.



Aquatic weeds and algae congesting water column.

Contact: Dale Lindeman | Reclamation's Pacific Northwest Region
208-378-5320, dlindeman@usbr.gov



Level sensors being tested at site near Yuma, Arizona. The site contains a stilling well (1), pressure transducers (2), and ultrasonic level sensors (3).

FY 2015 Initiatives

Field Evaluation of Water Level Sensors

Water level sensors are a vital component for use of electronic technologies in improving canal operating capabilities. Level sensor failures can, and on occasions have, resulted in damages that can cost a water delivery entity order of magnitude more than the original price of the sensor.

This research project will be continuing database compiling and documenting which water level sensors provide accurate measurements over typical irrigation usage. To date the sensors have been installed and the data are being collected and analyzed. This fiscal year each sensor will be re-calibrated to determine if slopes and offsets have changed over the previous irrigation season.

Contact: Bryan Heiner | Reclamation's Technical Service Center
303-445-2140, bheiner@usbr.gov

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Improving Coanda-Effect Screen Technology

This research will improve the adoption of Coanda-effect screen technologies for water intakes on Reclamation projects. Screening of trash, plant materials, and fish is often needed to facilitate efficient water operations, preserve fish resources, and prevent the spread of non-native plant and fish species. Coanda-effect screens are relatively self-cleaning compared to other screen technologies and are often considered for sites that are not continuously manned. Previous Reclamation research has produced design tools used to predict screen flow capacity. This new research will focus on testing a broader range of screen materials, evaluating debris clogging issues, investigating screen cleaning methods, and performing field evaluations of prototype screens installed in recent years. The research funding will also enable Reclamation to consult with and learn from parallel research studies being conducted by other organizations in the United States and Canada.

Contact: Tony Wahl | Reclamation's Technical Service Center, 303-445-2155, twahl@usbr.gov



A small onfarm Coanda-effect screen near Grand Junction, Colorado, is used to remove fine debris from irrigation water before it enters a pressurized pipe delivery system.



The Minnesota Creek Coanda-effect structure was installed in FY 2014 to divert and screen up to 60 cubic feet per second for irrigation use near Paonia, Colorado.



The SonTek-IQ mount installed in the South Gila Canal near Yuma, Arizona.

Field Evaluation of Low-Cost Ultrasonic Flow Meters

A SonTek-IQ flow meter was installed in the South Gila Canal near Yuma, Arizona. The SonTek-IQ was selected for field evaluation based on the laboratory results presented in, *Laboratory Evaluation of Open Channel Area-Velocity Flow Meters* (www.usbr.gov/research/projects/download_product.cfm?id=554 detail.cfm?id=6578).

In fiscal year (FY) 2014, the site was selected and the SonTek-IQ mount was developed. Early in FY 2015, the sensor was installed in the canal and is currently collecting data that will be compared to a U.S. Geological Survey site nearby. Once Reclamation researchers are satisfied with comparison flows, the flow meter will be used to automate the South Gila Canal turnout gate.

Contact: Bryan Heiner | Reclamation's Technical Service Center 303-445-2140, bheiner@usbr.gov



Science & Technology Program

Sustainable Water Infrastructure and Safety Research Projects

This research is focused on improving the reliability of Reclamation water storage and delivery facilities by producing or advancing effective solutions, tools, and practices that Reclamation facility managers use to maintain, modernize, and extend the life of Reclamation's aging infrastructure. Improvements and technological advances range from structural condition assessment and performance monitoring to repair, maintenance, and public and employee safety.

FY 2014 Highlights

Potentiodynamic Polarization Testing to Confirm the Suitability of Zinc Anodes in Natural Waters

This research will evaluate when zinc galvanic anodes should be effective in providing cathodic protection of steel structures in fresh waters. Galvanic anode cathodic protection is a method of mitigating corrosion by galvanic action. In some fresh waters, zinc galvanic anodes can form a surface film, a process called passivation, and thus lose their ability to protect an immersed structure. The chemical constituents of fresh water that will cause this passivation were investigated in the first phase of this study. It was found that components that can either induce or prevent passivation are qualitatively known; but their interplay

is complex and a chemical analysis basis for determining passivation is not generally established. Furthermore, field exposure testing to ascertain passivation can take months. On the other hand, potentiodynamic polarization, an electrochemical investigation technique, might provide a quick and simple way to test for this behavior, thus preventing the use of zinc anodes where they will not be effective. During the next part of the investigation, Reclamation researchers will attempt to develop a potentiodynamic polarization screening test of zinc anode material for fresh waters.



Typical zinc anodes; bagged for burial (top) and bare for immersion (bottom).

Contact: Roger Turcotte | Reclamation's Technical Service Center, 303-445-2383, rturcotte@usbr.gov

Evaluating Methods to Seal Leaking Contraction Joints

Many of Reclamation's concrete dams were constructed with contraction joints that contain metal waterstops to prevent water leaks through the joints. While these waterstop materials worked well for many years, as the contraction joints flex and move, some of the waterstops are failing. In some cases when they fail, they can allow large amounts of water into galleries and equipment rooms within the dam, causing significant maintenance and safety issues. A number of repair methods have been investigated over the years. Repairing failed waterstops in contraction joints has proven to be very difficult, expensive, and is usually ineffective, or only effective for a short time.

A novel approach was recently tested using a solid form of hydrophilic polyurethane that was ground up into fine particles. A simple pump and piping system was used to deliver the particles to a depth over 200 feet near the leak in the contraction joint, where the leaking water pulled the particles into the joint. Preliminary results using this approach appeared to be very successful.

Contact: Warren Starbuck or Kurt Von Fay | Reclamation's Technical Service Center
303-445-2317, dstarbuck@usbr.gov or 303-445-2399, kvonfay@usbr.gov

Use of Tablet Computers for Field and Laboratory Work

This scoping study evolved from a Research Jam idea with the goal of answering the questions of if and how Reclamation could effectively implement tablet computers, such as the iPad, as tools for field and laboratory work. In order to maximize the usefulness of a tablet for field work, a need was identified for an app that could combine the functionality of a camera, GPS, and notepad in a single interface that could guide users through the data collection process. Various avenues for custom app development were investigated, but an app developed at the U.S. Army Corps of Engineers-Information Technology Laboratory proved to be the versatile and customizable tool that Reclamation was searching for. The Mobile Information Collection Application (MICA) was field tested by Reclamation staff on the Mni Wiconi Core Pipeline in Pierre, South Dakota, for collection of cathodic protection system data. It improved both the efficiency of data collection and functionality of the data, as each test station is now GPS located with photographs and data for future years' testing. This research project has received additional funding for fiscal year 2015 to develop a long-term data storage and analysis solution and to investigate Reclamation-wide implementation solutions for MICA.

Contact: Jessica Torrey | Reclamation's Technical Service Center, 303-445-2376, jtorrey@usbr.gov

FY 2015 Initiatives

Three-Dimensional Scanning to Three-Dimensional Printing Technology Development (Precision Prototyping)

Precision Prototyping is a term referred to the process of re-creating complex object geometries using a three-dimensional (3D) solid modeling approach. Laser scanning tools to reverse engineer and replicate objects or a series of mechanical components is becoming standard method for efficient fabrication. Various industries (automotive, oil and gas, etc.) are harnessing new robust technologies to replicate or validate complex objects using a sophisticated workflow combining 3D laser scanning, numerical solid modeling, and 3D printing. Governmental organizations such as Reclamation can now benefit greatly from these new technologies in areas such as: replicating and re-engineering aging infrastructure components and mechanical parts, fabricating physical scale models to utilize in the hydraulic laboratory environment, performing hydropower diagnostic measurements and testing of installation components, or developing physical scale models of existing infrastructure for planning and analysis.



Three-dimensional scanning of mechanical pipe components into a 3D point cloud; used for 3D modeling and 3D printing fabrication process.

Contact: D.J. Bandrowski | Reclamation's Mid-Pacific Region. 530-623-1811, dbandrowski@usbr.gov

Composite Materials for Infrastructure

This research study will examine the use of composite materials as replacements for steel in water infrastructure rehabilitation. Engineered composite materials are made from two or more constituent materials that, when combined, produce a material with characteristics different from the individual components. For example, fiber-reinforced polymers are composites commonly used as construction materials. The research team has identified several infrastructure components where the corrosion resistance, lightweight nature, and impact and abrasion resistance of construction composite materials may provide an excellent alternative to steel. In collaboration with researchers at the U.S. Army Corps of Engineers-Construction Engineering Research Laboratory (USACE-CERL), the research team will review available products and current industry practice for use of composites in key areas such as: pipelines, coatings, and low-risk infrastructure (fish screens, trashracks, stoplogs, etc.). A fourth focus area will be in the accelerated testing of composite materials. This knowledge will be leveraged to prepare a roadmap for future research, collaboration, and implementation of composite materials at Reclamation and USACE.

Contact: Jessica Torrey | Reclamation's Technical Service Center
303-445-2376, jtorrey@usbr.gov

Comparative Analysis on Reducing Concrete Shrinkage and Cracking

Concrete is typically jointed to cause cracks to occur at particular locations. Cracks occur to alleviate tensile stress from internal strains that can be generated by restraint, temperature, chemical shrinkage, and/or drying shrinkage. Joint spacing is generally selected using rules of thumb, which were primarily based on older cement composition. During construction, requests are often made to extend the distances between joints and/or eliminating joints to increase the speed of construction and save in scheduling costs. Although many newer products and techniques claim to have an effect on concrete cracking, there is very little consistency in the testing and very little data available to compare the crack resistance of a concrete material made with different materials.

This research project is the first step towards a more comprehensive process to look at a number of products and/or techniques and compare them using the same suite of laboratory and field tests. This step is needed to be able to quantify the properties that can be achieved with today's cementitious components and to allow Reclamation the tools to specify appropriate and relevant properties when designing large concrete structures.

Contact: Katie Bartojay | Reclamation's Technical Service Center
303-445-2374, kbartojay@usbr.gov



Photographs showing ring tests, which is one of the standard tests for concrete shrinkage.



Science & Technology Program

Environmental Issues in Water Delivery and Management Research Projects

This research seeks to improve the reliability of Reclamation water deliveries by producing effective solutions, tools, and practices that Reclamation water managers can use to prevent water conflicts with the environmental demands on water supplies. Improvements and technological advances are pursued in fish passage and entrainments, ecosystem needs, aquatic and riparian invasive species, river and reservoir restoration, and sediment management.

FY 2014 Highlights

Discounting for Long-Lived Water Resource Investments

Exponential (classic) discounting has been taught to engineers, economists, and finance specialists, and routinely employed for decades. When exponential discounting is employed, costs and benefits occurring in the distant future have practically no influence on the investment decision. A number of newly emergent discounting approaches have been described in recent years. Arguably, these new discounting approaches may better represent future economic uncertainty, regional and intergeneration equity, and sustainability considerations. As a group, these new discounting techniques may be better suited for the analysis of long-lived infrastructure and environmental investments. A subset of these new discounting approaches is described in this scoping study. These include, Ramsey discounting, hyperbolic and quasi-hyperbolic discounting, gamma discounting, Weibull discounting, Green Book discounting, and intergenerational discounting.

Many of these new discounting approaches result in declining discount rates (DDRs) over time. DDRs are inconsistent with the underlying tenants of economic theory and can result in suboptimal choice reversals. Even so, DDR approaches have been adopted for official use elsewhere, including France and the United Kingdom. Exploratory use of these new discounting approaches for cost benefit analysis has demonstrated they can have a profound influence on the outcome of an analysis, and hence any policy prescriptions which may follow. This is equally true for environmental programs and for traditional construction and resource extraction projects. At this time, these newly emergent discounting approaches have not been professionally accepted nor sanctioned for official use in the United States (U.S.). Nonetheless, they appear to hold some promise for the analysis of long-term water resource investments. (See “Application of New Discounting Approaches for Long-Lived Water Resource Investments” on next page.)

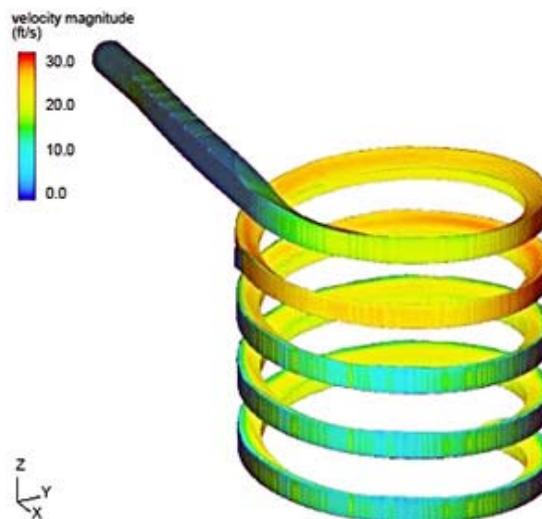
Contact: Dave Harpman | Reclamation’s Technical Service Center, 303-445-2733, dharpman@usbr.gov

Downstream Passage for Storage Reservoirs

Reclamation’s work on downstream fish passage for Cle Elum Dam has already led the way in the initial development of a Helix design that will allow self-guided passage in a reservoir where water surface fluctuations are greater than 50 feet in elevation. Successful and extensive physical and numerical modeling from the Cle Elum Dam project will be used as a starting point for developing a more general design that can be adapted for widespread application to damsites throughout the U.S.

Numerical analyses will be conducted using tools from FLOW-3D software (or similar computational fluid dynamics code) to take the Helix design developed for Cle Elum Dam and apply it to other sites where the discharge range, elevation drop, and velocity criteria requirements are different from those at Cle Elum Dam. Using the CFD modeling tools and a range of criteria, optimal Helix geometry for each case study will be established and used to determine the limits of this application for other sites throughout Reclamation.

Contact: Leslie Hanna, Jim Higgs, or Jason Wagner | Reclamation’s Technical Service Center
303-445-2146, lhanna@usbr.gov;
303-445-2147, jhiggs@usbr.gov;
or 303-445-3136, jwagner@usbr.gov



Flow simulated in Cle Elum Dam Helix design at 300 cubic feet per second, using FLOW-3D software.

FY 2015 Initiatives

Synthesis of Ecological and Physical Effects of Dam Removal Projects

Dam decommissioning is rapidly emerging as an important river restoration strategy in the U.S. Hundreds of dams have been removed in the last few decades, including several large ones in recent years, such as Condit Dam and the Elwha River dams in Washington State. These removals and the studies associated with them provide for the first time an opportunity to evaluate the far-reaching consequences of these significant river perturbations and watershed restoration efforts, especially those resulting from removals of several tall structures (greater than 10 to 15 meters) during the last decade. Understanding dam removal response not only improves fundamental understanding of rivers—in particular landscape and ecosystem response to fluvial aquatic reconnection and profound sediment pulses—they also provide valuable lessons for managing river restoration.



The 20-member working group at the first Dam Removal Synthesis Meeting at the Powell Center in Fort Collins, Colorado, including two representatives from Reclamation's Technical Service Center, Jennifer Bountry and Tim Randle.

An effort to synthesize existing studies and data, thereby providing scientists and managers better knowledge of likely outcomes of future dam removals, is being sponsored by the U.S. Geological Survey's John Wesley Powell Center for Analysis and Synthesis (Powell Center) in Fort Collins, Colorado. The 20-member working group convened the first of two meetings on June 16 - 20, 2014, at the Powell Center. The group consists of Federal agency and academic biologists, hydrologists, geomorphologists, and engineers from throughout the U.S. Discussions and presentations during this first meeting revealed the tremendous growth of information from dam removals over the last few years and pointed to several common patterns of physical and biological responses. For example, reservoir size and sediment characteristics, in conjunction with the type and rate of dam decommissioning, appear to lead to predictable relations between processes eroding reservoir sediment and the downstream sediment transport and channel response, which in turn affect biological conditions and trajectories. Reclamation staff will participate in the overall synthesis of dam removal findings and a paper synthesizing metrics for sediment management. These types of findings and their scientific and management implications will be the focus of multiple analysis and reporting efforts over the next year as the group prepares for a synthesis and wrapup meeting in June 2015.

Contact: Jennifer Bountry | Reclamation's Technical Service Center, 303-445-3614, jbountry@usbr.gov

Application of New Discounting Approaches for Long-Lived Water Resource Investments

This research project will apply several newly described discounting techniques to one or more examples of long-lived water resource management problems. The objectives of this proposed effort are to: 1) identify barriers to the application of these new discounting approaches, 2) compare and contrast the results produced by these new approaches to the results obtained using traditional (exponential) discounting approaches, and 3) explore the implications of using these new discounting approaches in planning studies and routine cost benefit analyses.

Economic analysis of, for example, reservoir sustainability and sediment management measures, is often confounded by the extremely long time-horizons that must necessarily be considered. Traditional discounting procedures generally produce unfavorable results. Arguably, these outcomes are flawed since they do not account for the sustainable, multigenerational nature of such measures.

There are a number of new and emerging discounting techniques for use in the cost benefit analysis of long-lived water resource investment and management decisions. These newly described discounting procedures are able to explicitly characterize sustainability, intergenerational time-horizons and the equity considerations common to these kinds of decisions. Reclamation's research will apply these new techniques to one or more example long-lived water resource management problems. This research project arises from discussions held during the Reclamation Science and Technology Program-sponsored Reservoir Sustainability Workshop held in Lakewood, Colorado, in July 2012, and is informed by the fiscal year 2014 scoping study (see "Discounting for Long-Lived Water Resource Investments" on previous page).

Contact: Dave Harpman | Reclamation's Technical Service Center, 303-445-2733, dharpman@usbr.gov



Water and Climate

Research and Development Office Chief of Research



Levi Brekke
303-445-2494
lbrekke@usbr.gov

Levi joined the Research and Development Office (Research Office) in March 2011, serving as the Research Office's water and climate liaison to various science organizations, including the U.S. Department of the Interior's Climate Science Centers and the National Oceanic and Atmospheric Administration's Regional Integrated Sciences and Assessments. On January 26, 2015, Levi assumed his new responsibilities as Chief of Research and Development.

Prior to joining the Research Office, Levi spent 6 years at Reclamation's Technical Service Center and 2 years in Reclamation's Mid-Pacific Region, focusing on technical coordination and implementation of reservoir systems analyses and hydroclimate studies. Levi's education includes a B.S.E. degree in civil engineering (University of Iowa), M.S. degree in environmental science and engineering (Stanford University), and Ph.D. in water resources. His work experience includes time spent in the private sector, consulting in the areas of wastewater and water treatment engineering.

FY 2014 Highlights

Reclamation's Science and Technology (S&T) Program continued to improve tools and support updates to climate information supporting water management in a changing climate, addressing variability challenges from floods to droughts, and dealing with the longer-term prospects of climate change. Highlights include (see "Partnerships" below for acronym definitions):



- Partnered with collaborators (see figure) to release updated future hydrology projections issued through the World Climate Research Programme's Coupled Model Intercomparison Project-Phase 5 (CMIP5), downscaled to locally relevant resolution necessary for planning.
- Teamed with NCAR and USACE to develop new methods in climate projection downscaling and hydrologic projection, aimed at providing more reliable information for long-term planning.
- Worked with NOAA and CIRES to evaluate warm-season extreme precipitation events in a changing climate along the Colorado Front Range. Project methods are being featured in a fiscal year (FY) 2014 - 2015 research-to-applications project, supporting Reclamation's ongoing Dam Safety Office issue evaluation at Taylor Park Dam, Colorado.
- Published the third edition of the *Literature Synthesis on Climate Change Implications for Water and Environmental Resources*
- Pilot-delivered two new climate impacts training courses for a mix of Federal and non-Federal students, in partnership with CCAWWG and UCAR's COMET Program.

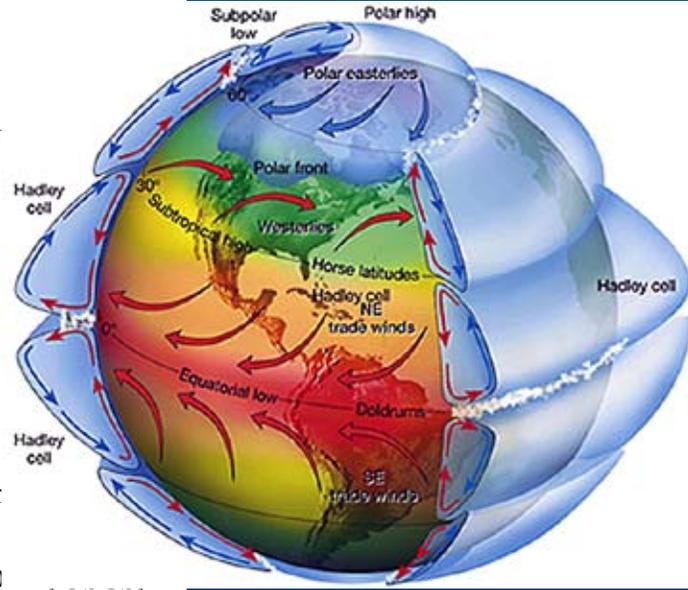
Partnerships

Reclamation's S&T Program actively partners with Federal and non-Federal groups to conduct research on addressing climate change and variability impacts in water management. Current partners include:

- California Energy Commission's Public Interest Energy Research Program
- Climate Change and Water Working Group (CCAWWG)
- Cooperative Ecosystem Study Unit Member Universities
- National Aeronautics and Space Administration's (NASA) Jet Propulsion Laboratory (JPL)
- National Center for Atmospheric Research (NCAR)
- National Oceanic and Atmospheric Administration's (NOAA) Earth System Research Laboratory
- NOAA's Regional Integrated Science and Assessment Centers
- Scripps Institution of Oceanography (Scripps)
- U.S. Army Corps of Engineers (USACE)
- U.S. Department of Agriculture's (USDA) Agriculture Research Service (ARS)
- USDA's Forest Service
- U.S. Department of the Interior's (DOI) Climate Science Centers
- U.S. Geological Survey (USGS)
- University Corporation for Atmospheric Research's (UCAR) COMET Program
- University of California-San Diego's Center for Western Weather and Water Extremes
- University of Colorado-Boulder's/NOAA's Cooperative Institute for Research in Environmental Sciences (CIRES)

FY 2015 Initiatives

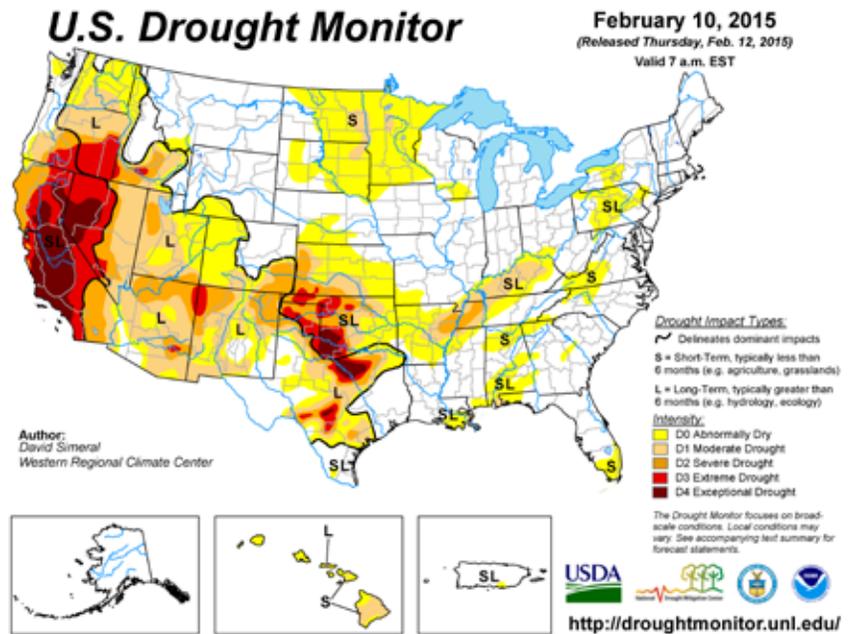
- *Advancing Streamflow Prediction During Conditions From Floods to Droughts:* Support several efforts aimed at improving short-term hydroclimate prediction that will assist present-day water management (partnering with USACE, NCAR, USDA's ARS, NASA's JPL, and others).
- A key FY activity (USACE and NCAR) involves conducting streamflow hindcasts in Western United States basins using advanced methods evaluated in FYs 2013 and 2014 and setting up an experimental real-time forecasting system to continue testing these methods during FYs 2016 and 2017.
- *Improve Climate Change Impacts Decision Support:* Partner with Federal and non-Federal teams to create and demonstrate advanced methods for developing downscaled climate and hydrologic projection (NCAR, USACE, and USDA's ARS).
- *FY 2015 CCAWWG Climate Change Workshop:* Joining USACE, NOAA, NASA, and other participating CCAWWG members, Reclamation will co-host this workshop to gather community perspectives and will help inform the FY 2016 update to CCAWWG's FY 2011 assessment on climate change user needs.



Atmospheric general circulation and its global-to-regional features that affect climate in the Western United States.



- *Inform Climate Change Adaptation Planning:* Develop and issue improved CMIP5 daily downscaled climate projections using the new technique, "Localized Constructed Analogs" (Scripps, California Energy Commission, CIRES, and USACE), and increase community access to these datasets (USGS, Brigham Young University; and DOI Landscape Mitigation Measure Response).
- *Develop Climate Technical Skills:* Continue collaboration with UCAR's COMET Program and CCAWWG to develop, pilot, and offer climate change training focused on impacts assessment skills, adding a new less-technical course series in FY 2015 aimed at program managers, project leads, and resource specialists.
- *Weather Modification Position Paper:* Lead development of an updated Reclamation position paper related to winter orographic cloud-seeding applications, focusing on current views surrounding scientific efficacy and legal/liability issues (partnering with CIRES). To support paper development, the Research and Development Office hosted a workshop in Denver, Colorado, on November 25, 2014, to gather perspectives from research and operations community members.



Advanced Water Treatment

Research and Development Office Advanced Water Treatment Research Coordinator



Yuliana Porrás-Mendoza
303-445-2265
yporrasmendoza@usbr.gov

Yuliana Porrás-Mendoza is the Research and Development Office's (Research Office) Research Coordinator for Advanced Water Treatment. Prior to joining the Research Office, Yuliana worked as a chemical engineer in Reclamation's Technical Service Center working in the area of water treatment and membrane development research.

Yuliana has been with Reclamation for over 13 years. She has a Bachelors of Science in Chemical Engineering and a Masters of Science in Environmental Science and Engineering from the Colorado School of Mines, as well as a Masters of Science in Technology Commercialization from the University of Texas.

Yuliana also serves on the Board of Directors of the Society of Hispanic Professional Engineers.

FY 2014 Highlights

Reclamation's Science and Technology Program and Desalination and Water Purification Research Program supported a diverse portfolio of research projects in the area of Advanced Water Treatment (AWT) in fiscal year (FY) 2014. The projects leveraged collaboration between Reclamation researchers, area offices, the private sector, municipalities, other Federal agencies, and universities to develop and evaluate novel technologies for the treatment of non-traditional water supplies. Major accomplishments include:

- Worked with the Environmental Protection Agency and the U.S. Department of Agriculture's Agricultural Research Service to launch the "Advanced Water Treatment Community of Practice" to foster collaboration and innovation between the Federal agencies working in the field of water treatment. For more information contact Saied Delagah, 303-445-2248, sdelagah@usbr.gov.
- Partnered with the University of Arizona to design, build, and test a solar-powered membrane distillation desalination unit for the production of livestock water on the Navajo Reservation in Leupp, Arizona. For more information contact Mitch Haws, 623-773-6274, mhaws@usbr.gov.
- Designed and constructed an agricultural research area at Reclamation's Brackish Groundwater National Desalination Research Facility (BGNDRF) in Alamogordo, New Mexico, to evaluate the use of saline water for irrigation of halophytes and salt tolerant crops as a method of desalination concentrate management. For more information contact Randy Shaw, 575-443-6553, rshaw@usbr.gov.
- Tested a photovoltaic-powered reverse osmosis desalination unit and developed testing and data analysis protocol for comparing off-grid desalination technologies. This research was presented at the American Water Works Association Sustainable Water Management Conference in Denver, Colorado, on March 31, 2014. For more information contact Katie Guerra, 303-445-2013, kguerra@usbr.gov.
- Demonstrated desalination system automation technology by exposing membranes to challenge solutions and observing cleaning performance at Reclamation's BGNDRF. For more information contact Michelle Chapman, 303-445-2264, mchapman@usbr.gov.



Agricultural research area at BGNDRF in Alamogordo, New Mexico.



Photovoltaic-powered reverse osmosis testing at the Water Treatment Engineering and Research Laboratory in Denver, Colorado.

FY 2015 Initiatives

The FY 2015 AWT project portfolio features projects dedicated to the integration of desalination and renewable energy to provide drinking water to rural communities, cost-effective management of desalination concentrate, and technological innovations and improvements to decrease the cost and energy requirement for treating non-traditional water sources. The major activities for FY 2015 include the following:

- Providing technical guidance and facility support for the United States Agency for International Development (USAID) Desal Prize, which will feature innovators from around the world competing to demonstrate reliable, cost-effective treatment systems for small-scale potable and irrigation water using renewable energy. Reclamation's BGNDRF will host the semi-finalists round of competition in April 2015, where innovators will be selected to compete at the finals in Jordan in September 2015. For more information see www.thedesalprize.org or contact Saied Delagah, 303-445-2248, sdelagah@usbr.gov.
- Collaborating with the National Renewable Energy Laboratory to identify and design renewable energy infrastructure for the development of the renewable energy testing area at Reclamation's BGNDRF. This testing area will provide researchers with the capability to conduct a wide range of renewable energy desalination projects. Because the performance of renewable energy powered desalination technologies is dependent on feed water type, geographic location, and environmental conditions, an established testing site will be a major contribution to research in the field of renewable energy desalination and will allow other researchers to compare their technology's performance to those previously tested at BGNDRF (on the same water type under similar geographic and environmental conditions). For more information contact Katie Guerra, 303-445-2013, kguerra@usbr.gov.
- Developing and commercializing chlorine resistant polyamide membranes based on the polymer chemistry patented by Reclamation researchers. Because of the high cost of membrane cleaning and replacement necessitated by biological fouling in desalination plants, a chlorine resistant membrane has the potential to reduce the cost of desalination by controlling biological growth within membrane systems. For more information contact Katie Guerra, 303-445-2013, kguerra@usbr.gov.



BGNDRF infrastructure preparation for semi-finalist USAID Desal Prize competition.

Reclamation Support for United States Agency for International Development Desal Prize

Today's brackish water desalination technologies face many challenges including high-energy use/cost, non-sustainable brine waste disposal strategy, and low percent recovery of product water. The Desal Prize seeks to innovate one device that contains the functionality to provide potable water for humans and water appropriate for livestock and crops.

The winning innovation will be selected based on fulfillment of criteria such as, to name just a few:

- It should provide both a potable- and agriculture-appropriate total dissolved solids (TDS) range
- Is powered by renewable energy
- Is cost efficient, portable, durable, environmentally sustainable, and technologically innovative

Reclamation's BGNDRF will host the Desal Prize semi-finalists testing their technologies for two 24-hour testing periods. Judges comprised of experts in the areas of water treatment, agriculture, and renewable energy will select the finalist to compete for the grand prize.

More Information

<http://www.usbr.gov/research/AWT/>

<http://www.usbr.gov/awt/>



Desalination & Water Purification Research

“New desalination and water purification technologies have the potential to assist Reclamation and its partners confront the widening imbalances between supply and demand in river basins throughout the West.

Fostering development of new technologies will help improve the options communities have to be resilient to climate change and meet future water demands.”

Lowell Pimley
Acting Commissioner,
Bureau of Reclamation



Some of the FY 2014 awarded projects will be tested at Reclamation's Brackish Groundwater National Desalination Research Facility in Alamogordo, New Mexico.

The Desalination and Water Purification Research (DWPR) Program is helping Reclamation and its partners confront widening imbalances between supply and demand in basins throughout the West through testing and development of new advanced water treatment technologies. It focuses on three main goals: 1) augment the supply of usable water in the United States; 2) understand the environmental impacts of desalination and develop approaches to minimize these impacts relative to other water supply alternatives; and 3) develop approaches to lower the financial costs of desalination so that it is an attractive option relative to other alternatives in locations where traditional sources of water are inadequate.

FY 2014 Award Highlights

Reclamation Awards \$1.4 Million to Nine Desalination and Water Purification Research Projects and Studies

In August 2014, Bureau of Reclamation Acting Commissioner Lowell Pimley announced that nine research projects and pilot studies were awarded funding to address desalination and water purification needs. Reclamation's DWPR Program will provide the funding for these nine projects, funding a total of \$1.4 million with a non-Federal cost share of over \$6 million.

Successful applicants were chosen through a competitive, merit-reviewed process. Entities that were eligible include individuals, institutions of higher education, commercial or industrial organizations, private entities, public entities or Indian Tribal governments. Entities, except institutions of higher learning, must cost-share at least 75 percent of the project cost.

Research Laboratory-Scale Projects—1-Year Projects

Research laboratory-scale projects are conducted to determine if a process is feasible. The following four research laboratory-scale projects were selected for funding in fiscal year (FY) 2014:

- **Subsurface Intake Study for Ocean-Water Desalination; West Basin Municipal Water District, California**
Reclamation Funding: \$150,000 / Total Project Cost: \$622,000
The West Basin Municipal Water District will be implementing a field study using a guidance manual it has prepared in order to test the viability of an ocean-water desalination subsurface intake. The district has conducted a research desktop study on available, or soon-to-be available, subsurface seawater intake technologies.
- **Advanced Pretreatment for Nanofiltration of Brackish Surface Water: Fouling Control and Water Quality Improvements; University of Houston, Texas**
Reclamation Funding: \$150,000 / Total Project Cost: \$202,698
Brackish surface waters typically contain higher concentrations of pathogenic microorganisms, turbidity, natural organic matter, and disinfection by-product precursors compared to brackish groundwater. This study will provide the necessary proof-of-concept to scale up advanced pretreatment and nanofiltration membranes for purification of brackish surface water to drinking water standards.
- **Development of Photovoltaic Electrodialysis Desalination System; California State Polytechnic University, Pomona**
Reclamation Funding: \$99,992 / Total Project Cost: \$99,992
California State Polytechnic University Pomona has developed and constructed a photovoltaic electrodialysis (PV-ED) system. In this project, the unit will be upgraded to produce between 500 and 10,000 liters per day of clean water for small communities.

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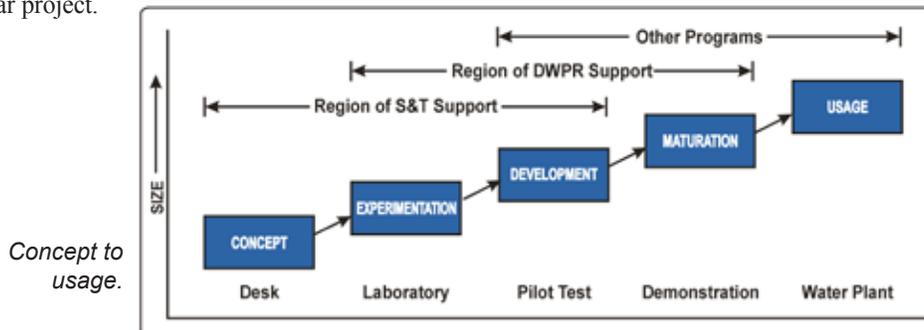
- **Activated Sludge Aeration Waste Heat for Membrane Evaporation of Desalination Brine Concentrate: A Bench-Scale Collaborative Study; University of Texas at San Antonio**
Reclamation Funding: \$85,587 / Total Project Cost: \$97,587

This study focuses on membrane evaporation processes to reduce brine volume. The study will investigate the potential of coupling membrane evaporation with waste heat generated from activated sludge aeration blowers.

New Pilot-Scale Projects—2-Year Projects (Second Year Funded Upon Successful Completion of First Year and Availability of Funds)

Pilot-scale projects are conducted to determine the physical viability and suitability of a process on a larger scale. The following three pilot-scale projects were selected for funding in FY 2014:

- **Demonstration of Monovalent Selective Ion Exchange Membranes for Desalination and Reuse Enhancement; New Mexico State University**
Reclamation Funding: \$199,944 / Total Project Cost: \$514,478
This project will pilot-test the newly developed monovalent selective ion exchange (IX) membranes from General Electric Water (CR671 and AR112B) on a 10- to 15-gallon-per-minute electro dialysis reversal unit at two test sites—Kay Bailey Hutchison Desalination Plant in El Paso, Texas, and Reclamation’s Brackish Groundwater National Desalination Research Facility in Alamogordo, New Mexico.
- **Pilot Testing Program for the Proposed Camp Pendleton Seawater Desalination Project; San Diego County Water Authority, California**
Reclamation Funding: \$200,000 / Total Project Cost: \$5,781,500
The San Diego County Water Authority has completed a series of feasibility and technical studies allowing for the phased implementation of a seawater reverse osmosis (SWRO) project with an initial capacity of 50 million gallons per day. This pilot testing program will focus testing on open ocean and subsurface intake options to provide feed water for an existing large-scale SWRO desalination plant.
- **Pilot-Scale Groundwater Desalter Brine Concentrator Study; Eastern Municipal Water District, California**
Reclamation Funding: \$131,057 / Total Project Cost: \$546,683
Under this study, the Eastern Municipal Water District (EMWD) is proposing to install and operate an advanced water treatment system for brine recovery to test and evaluate physical and chemical parameters under actual field conditions. This pilot-scale project is a 1-year project.



The DWPR Program covers a wide range of advanced water treatment technology and methods. Some recent topics have included establishment of an industry standard 16-inch filter element, development and testing of membrane bioreactor systems, minimization of membrane fouling, efforts toward zero discharge desalination, and desalination using natural freeze-thaw processes. Reclamation is particularly interested in research where the benefits are widespread and where Federal investment is needed.

Continuing Pilot-Scale Projects—2-Year Projects (Second Year Funding)

Two previously announced pilot-scale projects will receive funding for their second year. These pilot-scale projects are:

- **City of Corpus Christi Desalination Pilot Study; City of Corpus Christi, Texas**
Reclamation Funding: \$200,000 / Total Project Cost: \$1,600,000

The City of Corpus Christi has been dealing with extreme drought conditions over the last decade. This pilot-scale project is exploring a variety of options to optimize the pre-treatment process. These results will form the basis of design for a full-scale facility, including identifying operating parameters, preliminary cost information, and product water quality to assess the feasibility of a seawater and/or brackish groundwater supply.

- **Reverse Osmosis Concentrate Management Through Halophyte Farming; University of Arizona**
Reclamation Funding: \$186,328 / Total Project Cost: \$421,999

This project is evaluating the feasibility of irrigating halophytes and salt-resistant crops to manage concentrate produced from water desalination. This project is ongoing at Reclamation’s Brackish Groundwater National Desalination Facility in Alamogordo, New Mexico, and will enable the construction of the agricultural research testing area at the facility.

More Information

To learn more about Reclamation’s Desalination and Water Purification Research Program, please visit:

www.usbr.gov/research/AWT/DWPR/

Reclamation News Release for FY 2014 awarded projects:

www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=47709



Renewable Energy

Research and Development
Office Renewable Energy
Research Coordinator



Erin Foraker
303-445-2125
eforaker@usbr.gov

Erin Foraker joined the Research and Development Office (Research Office) in October 2012 as the Renewable Energy Research Coordinator. In this position, Erin directs the Research Office's renewable energy research program, which focuses on improving maintenance practices of hydropower systems, improving reliability and efficiency for hydropower generation, improving safety, and researching opportunities for other renewable energy generation within Reclamation.

Erin holds a Bachelors of Science in Mechanical Engineering from the University of Memphis and a Masters in Business Administration from the University of Denver, with over 20 years of power industry experience.

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FY 2014 Highlights and FY 2015 Initiatives

- Testing was performed at the Roza Canal near Yakima, Washington, to determine hydrokinetic (HK) device impacts on canal operations. Water surface elevations and canal velocities in the near and far vicinity of the HK turbine were gathered. The data will be used to calibrate a numerical model being developed. In fiscal year (FY) 2015, further testing will occur with different turbine configurations.
- The Parker Powerplant's Transformer Fire Protection System in Arizona/California was evaluated to determine potential threats from quagga mussels. Mussel loadings were measured and solutions proposed. Other areas of concern were identified and examined related to the transformer fire protection system. A summary of these areas will be provided in a report with all final decisions provided by Parker Powerplant management. The final report will be issued in FY 2015 discussing proposed solutions and preliminary cost estimates.

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Typical setup for water level and Acoustic Doppler Current Profiler (ADCP) instrumentation deployment at 12 measurement cross sections to determine current velocities during HK testing.



Reclamation's tagline and Rio Grande ADCP with the Ocean Science Riverboat, 32 feet upstream from the HK turbine. Canal velocities were measured at the same cross sections as the water surface elevations with and without the HK device operating for comparison.



Top left: Hayward automatic basket strainer installed inline on the main 8-inch raw water supply pipe that pulls water from the forebay, which also supplies the current transformer fire protection system.
Middle left: Mussel shell debris trapped by the Hayward strainer during both flow tests.
Bottom left: Mussel shell debris pulled out of the Hayward strainer after running both flow tests.
Bottom right: Transformer and transformer fire protection system installation.

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- Metal fiber brushes were installed on the Folsom Powerplant Unit 2, California, under the Reduced Cost Maintenance Project. As a result, further laboratory assessments were determined to be necessary. A test stand was designed and built to further evaluate metal fiber brushes in a laboratory setting to determine proper specifications of brushes and to develop processes for proper installation and wear in procedures. In FY 2015, further laboratory testing will be performed and results will be reported.

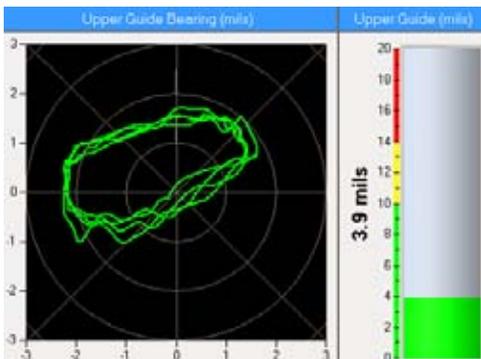
- A preliminary video was developed to demonstrate the benefits of engineered noise controls in powerplants. A final video will be delivered in FY 2015.

- In partnership between Reclamation's Research and Development Office and Phoenix Area Office, a preliminary report was developed to evaluate the engineering issues surrounding the installation of solar panels over Reclamation's canal systems. A final report will be delivered in FY 2015.



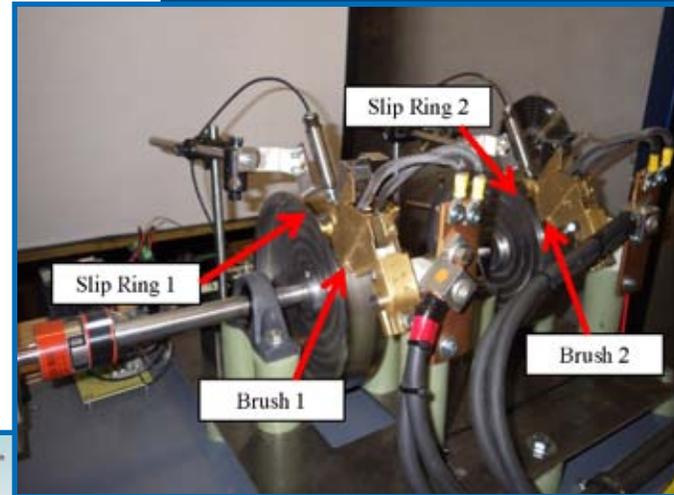
Gujarat India Solar Canal Project (Sardar Sarovar Narmada Nigam Limited). Illustrative photograph only.

- Reclamation's Technical Service Center (TSC) tested different grounding methods used in the electric utility industry. The recorded information was analyzed and the findings and results were then incorporated into Reclamation's Facility Instructions, Standards, and Techniques (FIST) manuals. These findings and results led to the development of mathematical methods to calculate worker exposure voltages where six temporary protective grounding scenarios were modeled to illustrate the effects. TSC participated with the Institute of Electrical and Electronic Engineers (IEEE) Standards Association to incorporate these findings into the latest edition of IEEE Standard 1246, IEEE Guide for Temporary Protective Grounding Systems Used in Substations. Contributing research results to inform the power industry through guides such as IEEE Standard 1246 will continue in FY 2015.



Partial screenshot of an orbital plot to determine a generator's vibration.

- Machine condition monitoring software was transitioned to a server/client platform and a machine condition monitoring system was installed on the left powerhouse at the Grand Coulee Powerplant, Washington. In FY 2015, a system will be installed at the Judge Francis Carr (J.F. Carr) Powerplant, California, to further monitor the cavitation on the units and inform operators of cavitation levels. See "Cavitation Detection Techniques for Optimizing Hydraulic Turbine Operation and Maintenance" on next page.



Top: Laboratory testing of metal fiber brushes.

Bottom: The face of a new metal fiber brush.

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“Erin Foraker, Renewable Energy Research Coordinator”

Prior to joining Reclamation in June 1999, Erin worked at the Tennessee Valley Authority in the Hydro Modernization Program and Fossil Power Engineering at the Allen Fossil Plant.

Prior to joining the Research Office, Erin worked in both Reclamation's Hydroelectrical Research and Technical Services Group and the Power Resources Office.

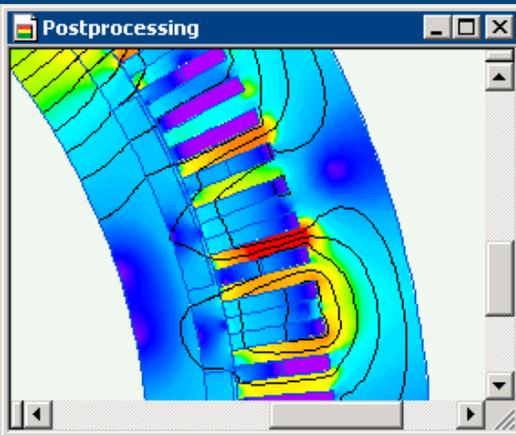
Erin has also served as chairperson and as a representative on several power industry committees.

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Renewable Energy

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- Hydropower models were improved through partnership with the National Renewable Energy Laboratory (NREL), especially on the Regional Energy Deployment System (ReEDS) model. A report describing the work performed was produced. Further improvements will be looked at in FY 2015 and future years.
- Finite Element Analysis (FEA) is being used to analyze generator failure conditions. Further modeling will be developed in FY 2015.
- Centre for Energy Advancement through Technological Innovation (CEATI) studies initiated:
 - ◇ Rotor keyway cracking study
 - ◇ Vibration alarm set points
 - ◇ Protection system testing survey
 - ◇ Generator start/stop report
- Ongoing CEATI studies:
 - ◇ Operation of hydrogenerators with bypassed stator coils
 - ◇ Hydro unit stator core and rotor pole replacement/refurbishment criteria



FEA of generator magnetic flux levels.



Jim DeHaan of Reclamation's TSC installing and configuring the machine condition monitoring system at Grand Coulee Powerplant, Washington (see last bullet on previous page).

Cavitation Detection Techniques for Optimizing Hydraulic Turbine Operation and Maintenance

A primary goal of FY 2014 research was to build an online cavitation monitor to identify, alarm, and trend cavitation activity over long-term operations. This goal was successful. Two cavitation monitors and a machine condition monitor were designed, parts procured, and the equipment fabricated for installation on Units 1 and 2 at the J.F. Carr Powerplant in northern California. Installation is scheduled for November 2014. The installation of these monitors will allow for better prediction of cavitation behavior over varying unit operations and reservoir elevations.



A prototype cavitation monitor undergoing tests at J.F. Carr Powerplant, California.



Cavitation damage to a turbine runner blade of J.F. Carr Unit 2 in February 2013. Photograph courtesy of John Germann.

— continued

— continued

Continued extensive cavitation testing was conducted on the two units at J.F. Carr. Cavitation repair work on the badly damaged J.F. Carr turbine runners was conducted on April 14 through June 30, 2014, by Reclamation's Northern California Area Office maintenance personnel. It was important that baseline cavitation signatures were determined and documented after the turbine runners were repaired and prior to any significant operation. Onsite testing was performed during a 4-day test period from June 27 through June 30, 2014. The cavitation testing was scheduled in June 2014 after the completion of the turbine runner repair work and prior to the critical water delivery requirements of both units to supplement the California drought conditions. Testing was successful. Not only were baseline cavitation signatures documented, but the new prototype permanent cavitation monitor was also tested.

Shear Pin Failure Prediction Through the Use of Acoustic Emission Sensing and Analysis

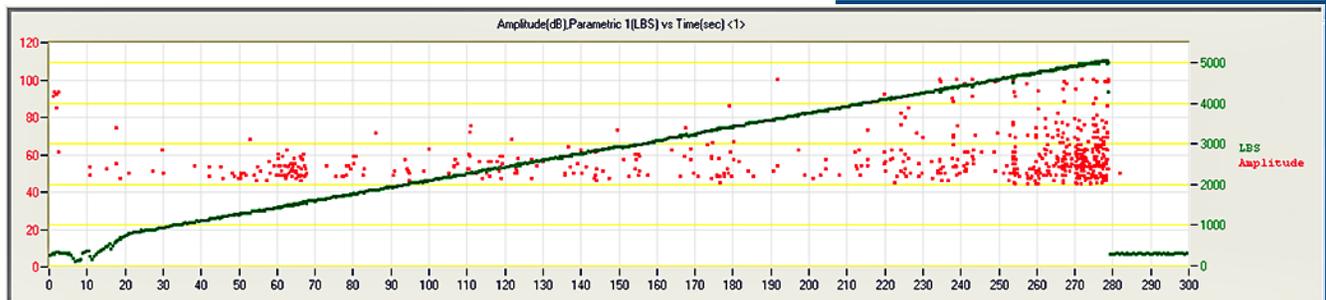
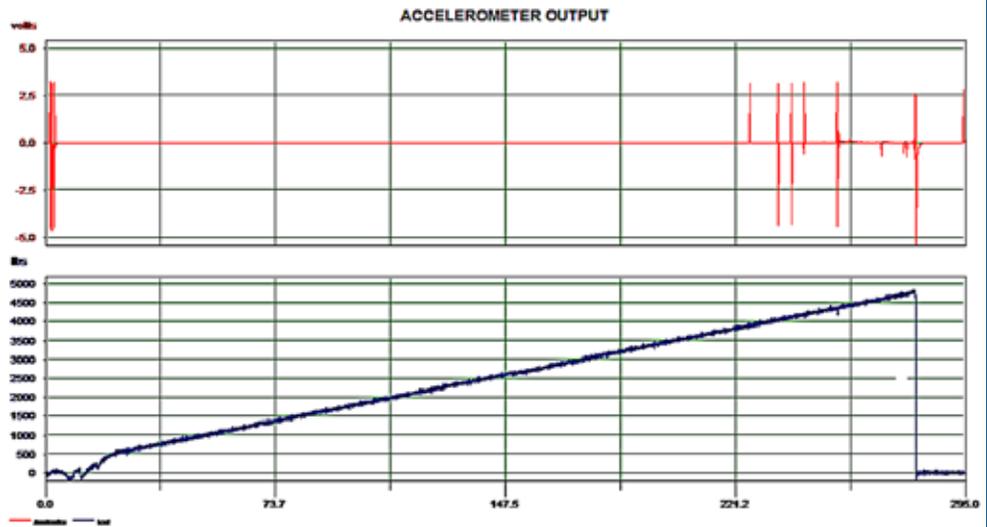
A series of tests on aluminum test specimens and powerplant aluminum shear pins were conducted with the 120,000-pound capacity Instron universal test machine in the Materials Engineering and Research Laboratory in Reclamation's TSC. The tests evaluated the use of two methods—acoustic emission and vibratory—to detect micro- and macro-crack propagation as a shear pin fails. The goal of these tests was to determine whether it is possible to detect the start of cracking in a shear pin prior to ultimate failure.

Findings found that both accelerometers and acoustic emission transducers work well in determining when a shear pin fractures. Only acoustic emission sensors can consistently detect changes in the material prior to ultimate failure. Efforts to monitor changes in the material using acoustic emissions were successful during crack initiation and propagation on an aluminum test specimen, but less successful when conducted with an actual shear pin.

Further research is required to determine a process to initialize a crack in test pins and whether to conduct testing of pins with cyclic loading to initiate fatigue damage. Further work will also focus on building a prototype shear pin failure detector using accelerometers.



John Germann field testing at J.F. Carr Powerplant, California.



Typical accelerometer and acoustic emission output during loading to failure of an aluminum test specimen.



Invasive Mussels

Research and Development Office Invasive Mussels Research Coordinator

Joe Kubitschek
Hydraulic Engineer
303-445-2148
jkubitschek@usbr.gov

Reclamation Detection Laboratory for Exotic Species

Denise M. Hosler
Botanist
303-445-2195
dhosler@usbr.gov



Plankton tow net sampling for quagga mussel monitoring on the Lower Colorado River System.



Quagga mussel veliger from the Lower Colorado River System.

Reclamation's Science and Technology (S&T) Program has continued to give mussel research activities a high priority. Efforts to improve monitoring and detection methods; identify, develop, demonstrate, and implement facilities protection technologies and strategies; and assess ecological impacts are ongoing. Collaborative activities between Reclamation's Research and Development Office, Technical Service Center, and Lower Colorado Region; other agencies; and private industry have continued to address the impacts of invasive mussels.

FY 2014 Highlights

Monitoring and Detection

In fiscal year (FY) 2014, the Reclamation Detection Laboratory for Invasive and Native Species in Denver, Colorado, adopted the new title, "Reclamation Detection Laboratory for Exotic Species" (RDLES). To date, the laboratory has analyzed over 14,645 water samples representing over 425 water bodies. RDLES staff produced numerous publications documenting improved techniques related to sample handling and detection of dreissenid mussels in raw water. Members of the RDLES staff presented their research findings at the Infrastructure Sustainability 2014 Research and Development Workshop held March 4 through 6, 2014, in Vicksburg, Mississippi. As a result, RDLES is working in cooperation with an environmental DNA (eDNA) Federal Work Group and collaborating on several invasive species research projects, including a mussel spread predictive model.

Ultraviolet Light Treatment

Cooling water system treatment using ultraviolet (UV) light has been demonstrated as promising for mussel control. A final report of findings on testing of unique UV treatment technology for reducing mussel settlement in a 4,000-gallon-per-minute cooling water subsystem at Reclamation's Davis Dam (Arizona/Nevada) was completed. The unit performed well with up to 95 percent (%) reductions, with a 50-millijoule-per-square-centimeter dose, and the technology is viewed as an option for implementation. However, careful consideration for specific technology features (including actual dose delivered) and site-specific conditions is required to ensure adequate performance.

Coatings Research (see the "Research Spotlight—Coatings" segment on pages 36 and 37)

In October 2014, an updated report titled, *Coatings for Mussel Control—Results From Six Years of Field Testing* was released. This report identifies silicone foul-release coatings that prevent mussel attachment and the progress towards development of durable foul-release coatings that are self-cleaning or prevent mussel attachment. See the "Multimedia Around Reclamation" segment in this issue for a video regarding this quagga and zebra mussels research testing and report.

Development of a Durable Foul-Release Coating

A Cooperative Research and Development Agreement (CRADA) was signed with an industrial partner to develop a durable coating that prevents mussel attachment. The joint partners have been able to increase the strength of the silicones; field results are pending.

Scale-Up Trashrack Coated With Foul-Release Coatings

A trashrack coated with foul-release coatings is in testing. The first year shows a small amount of damage during handling and installation, as well as on the upstream surface where the trash rake scrapes the surface.

Turbulence

Preliminary research investigating the effects of turbulence on mussel survival and settlement in cooling water systems has shown some promise. Settlement reductions of up to 50% were observed, suggesting that turbulence can achieve partial control of mussels in piped systems. Proposed modifications to improve efficacy are currently being considered.

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Copper-ion Generator

Testing on the effectiveness of copper-ion (Cu-ion) generators to control mussels in very low doses was recently completed. The findings suggest that Cu-ion generators, while showing some efficacy for settlement prevention, do not perform well from an electromechanical standpoint under the conditions at Davis Dam, Arizona/Nevada. Copper is well known to be toxic to mussels, but other copper delivery methods appear to be more practical.

Fish Screens

Field testing of two commonly used fish screen systems, including a cylindrical stainless steel wedgewire screen and a vertical traveling nylon screen, was completed at Lake Mead. The results indicate these systems have some inherently favorable characteristics in resisting fouling by quagga mussels.

Ecological Assessment

Monitoring of mussel populations on the Colorado River dams and seven points along the river in between the dams, as well as several backwaters, continued in FY 2014. Data were collected monthly at each site including larval mussel densities, adult mussel settlement, and over 50 water quality parameters.

FY 2015 Initiatives

Monitoring and Detection

- In FY 2015, RDLES staff will continue working on a relational database comprised of the environmental and mussel data collected since 2007 to be used for predictive purposes.
- In a cooperative S&T Program research project, RDLES staff will work with the U.S. Army Corps of Engineers (USACE) on a predictive modeling tool developed by USACE to predict future infestations.
- Laboratory technicians will continue research efforts to develop flow cell cytometry for larval enumeration, efficacy testing of control technologies, and establishment of baseline data for zooplankton populations in western reservoirs.

Facilities Protection Technologies

- Additional field performance testing of proposed improvements to turbulence generation technology is planned for FY 2015.
- Testing of pulsed pressure technology for control of mussel settlement on intake structures and within piped systems is planned for FY 2015, contingent on obtaining a suitable field test location.
- Additional research with emphasis on developing coatings that have improved durability and service life will continue in FY 2015.

Ecological Impacts

- The remaining profile data for physical variables (temperature, dissolved oxygen, pH, and conductivity) from the early detection program will be integrated into the project database so that the relationships between presence of veligers and environmental conditions can be more thoroughly evaluated.
- Monitoring of mussel populations and water quality along the lower reaches of the Colorado River, as well as several backwaters, will continue in FY 2015 in an effort to identify environmental conditions affecting mussel populations.



RDLES staff at the Aurora Water Festival Quagga Mussel Education Program for elementary students in Colorado.

Invasive Mussels Research Projects Contact Information

- **Monitoring and Detection,**
Denise Hosler, 303-445-2195,
dhosler@usbr.gov
- **Coatings Research,**
Allen Skaja, 303-445-2396,
askaja@usbr.gov
- **Ultraviolet Treatment,**
Leonard Willett, 702-494-2216,
lwillett@usbr.gov
- **Copper-ion Generators,**
Leonard Willett, 702-494-2216,
lwillett@usbr.gov
- **Turbulence Research,**
Joshua Mortensen, 303-445-2156,
jmortensen@usbr.gov and
Sherri Pucherelli, 303-445-2015,
spucherelli@usbr.gov
- **Fish Screening/Predation,**
Catherine Karp, 303-445-2226,
ckarp@usbr.gov and
Joshua Mortensen, 303-445-2156,
jmortensen@usbr.gov
- **Ecological Assessments/Impacts,**
Scott O'Meara, 303-445-2216,
someara@usbr.gov and
George (Chris) Holdren,
303-445-2178, gholdren@usbr.gov
- **Pulsed Pressure,**
Joe Kubitschek, 303-445-2148,
jkubitschek@usbr.gov and
Sherri Pucherelli, 303-445-2015,
spucherelli@usbr.gov



Research Spotlight—Coatings

Allen Skaja

Protective Coatings Specialist

303-445-2396

askaja@usbr.gov

Allen Skaja received a Bachelor's degree in Chemistry and a Ph.D. in Coatings and Polymeric Materials from North Dakota State University in 2005. Allen has a Protective Coatings Specialist (PCS) certification from the Society for Protective Coatings (SSPC), formerly known as the Steel Structures Painting Council.

David Tordonato

Materials Engineer

303-445-2394

dtordonato@usbr.gov

David Tordonato received a Bachelor's and Master's degree in Mechanical Engineering from Virginia Tech in 2002 and 2003, respectively, and a Ph.D. in Materials Engineering from the Colorado School of Mines in 2008.

David is a National Association of Corrosion Engineers Coatings Inspector (NACE CIP Level 2) and a Society of Professional Rope Access Technician (SPRAT Level II). He also has a NACE Cathodic Protection Tester certification (CP1).

Rick Pepin

Protective Coatings Specialist

303-445-2391

rpepin@usbr.gov

Rick Pepin received a Bachelor's degree in Materials Engineering from Montana State University in 1983. Rick is a SSPC PCS and a NACE CIP Level 2. Rick primarily writes coating specifications and performs inspections.

The coatings group in the Materials Engineering and Research Laboratory in Reclamation's Technical Service Center provides guidance on the coatings and corrosion protection used on Reclamation's infrastructure. The group has extensive knowledge in the historical coatings used by Reclamation including coal tar enamel, vinyl resins, and lead-based paint. These coatings provided an extremely long service life. Unfortunately, they can no longer be used due to environmental concerns, and today's coatings provide a much shorter service life. The coatings group seeks creative solutions to protect and preserve Reclamation's infrastructure without shortening these coatings maintenance cycles. Other research challenges include non-fouling coatings for zebra/quagga mussel control and field measurements to predict remaining coatings service life.

FY 2014 Highlights

Field Evaluation of Mussel Resistant Coatings

Since 2008, the coatings team has evaluated over 100 coatings and materials to mitigate and prevent mussel attachment. The coatings group also has six Material Transfer Agreements (MTAs) with private sector companies or universities to evaluate experimental coatings. In October 2014, a new report was released to the public titled, *Coatings for Mussel Control—Results From Six Years of Field Testing*. This report highlights silicone foul-release coatings that prevent mussel attachment and the progress made in finding durable foul-release coatings that are self-cleaning or prevent mussel attachment. Jotun SeaLion Resilient showed great promise for a system that is a hard durable coating and is self-cleaning. An experimental product from an MTA partner had two different formulations that were durable and prevented mussels from attaching.

Electrochemical Impedance Spectroscopy Field Demonstration

Electrochemical Impedance Spectroscopy (EIS) can be a valuable tool for determining the remaining service life of a coating. The coatings team has evaluated several aged coatings on Reclamation infrastructure to assess the remaining service life, including vinyl resin, coal tar enamel, and lead-based paint. EIS has also been used in the analysis of a premature coating failure.



Laboratory analysis of coatings for water immersion service.

Development of a Durable Foul-Release Coating

A Cooperative Research and Development Agreement (CRADA) was signed with an industrial partner to develop a durable coating that prevents mussel attachment. The joint partners have been able to increase the strength of the silicones; field results are pending.



Applying protective coatings to a trashrack.

Scale-Up Trashrack Coated With Foul-Release Coatings

A trashrack coated with foul-release coatings is in testing. The first year shows a small amount of damage during handling and installation, as well as on the upstream surface where the trash rake scrapes the surface.

FY 2015 Initiatives

In collaboration with the U.S. Army Corps of Engineers, investigate the following historical coatings used by both organizations to answer key questions:

- What material or chemical properties of coal tar enamel, coal tar epoxy, and CA-50 were the driving forces of their extremely long service lifetimes?
- How can Reclamation find or develop a green alternative to vinyl resin paints?

Coatings Group Research and Capabilities

- **Consultation:** Expert knowledge in coatings for all service conditions. Special expertise in corrosion protection and zebra mussel control.
- **Coatings Specifications:** Experienced in writing and reviewing coatings specifications for Reclamation's regional and area offices, addressing all aspects and ensuring appropriate materials selection.
- **Field Services:** Provide a wide variety of field services including inspection, maintenance planning, troubleshooting coatings problems, and ropes access inspections.
- **Applied Research:** Conduct and report comprehensive laboratory and field research projects related to Reclamation's coatings needs.



Zebra/quagga mussel coatings evaluations during Lower Colorado River field testing at Parker Dam (Arizona/California). The silicone foul-release coatings prevent attachment of mussels.



Bobbi Jo Merten

Protective Coatings Chemist

303-445-2380

bmerten@usbr.gov

Bobbi Jo Merten received a Bachelor's degree in Chemistry and Mathematics from Marian University in 2006 and a Ph.D. in Coatings and Polymeric Materials from North Dakota State University in 2011. Bobbi Jo is a NACE CIP Level 2 and also has a CPI.

Cathy Chan

Materials Engineer

303-445-2390

cchan@usbr.gov

Cathy Chan received a Bachelor's and Master's degree in Materials Engineering from Stony Brook University in 2014. Cathy started with Reclamation in August 2014.



Coatings Team Left to Right: Bobbi Jo Merten, David Tordonato, Allen Skaja, Rick Pepin, and Cathy Chan.

More Information

See the "Multimedia Around Reclamation" segment in this issue for videos regarding MERL and the quagga and zebra mussels research testing and report.

For more photographs see back cover.



Technology Transfer

Research and
Development Office
Deputy Chief of Research



Chuck Hennig
303-445-2134
chennig@usbr.gov

Chuck Hennig graduated from Colorado State University in 1978 with a Bachelors of Science in Civil Engineering. Between 1979 and 1991, Chuck served as a design engineer on many major dam construction and rehabilitation projects.

From 1991 to 2000, Chuck became a Dam Safety Program Manager and, later, the Deputy Chief of Reclamation's Dam Safety Office.

In 2000, Chuck became the Research and Development Office's Research Coordinator for Reclamation's Science and Technology Program and then, ultimately, the Technology Transfer Manager and Deputy Chief of Research.

The transfer of Reclamation's technology and knowledge maximizes benefits to its stakeholders and customers, the American public, and the national economy. The majority of Reclamation's technologies are transferred through public dissemination, while others require the capabilities and know-how of the private sector to mature, mass produce, and commercialize the technology into market-ready products. If an industry partner is needed to transfer the technology into a market-ready product, Reclamation utilizes the authorities available under the Federal Technology Transfer Act (FTTA) to protect intellectual property, as needed, and form research and licensing partnerships with United States (U.S.) manufacturing industries. Reclamation utilizes these authorities to ensure its research and development investments maximize economic, environmental, and social benefits to the American public. Examples of technology transfer activities authorized under the FTTA are summarized below.

FY 2014 Highlights

Re-Delegation of the Reclamation Commissioner's Authority to Implement Technology Transfer Activities

The U.S. Department of the Interior's Technology Transfer Delegation Departmental Manual (207 DM 8) issued on October 6, 2011, delegated the Secretary of the Interior's authority under the Stevenson-Wydler Technology Innovation Act of 1980 and the Federal Technology Transfer Act of 1986 to Bureau Directors.

In accordance with 207 DM 8, Reclamation's Commissioner re-delegated these authorities to Reclamation's Director of Technical Resources on October 10, 2013, through release No.476 of Reclamation's Delegations of Authority Reclamation Manual. The Director of Technical Resources further re-delegated these authorities to Reclamation's Chief of Research and Development through a formal re-delegation memorandum dated December 23, 2013.

Reclamation's efforts to re-delegate these authorities are critical to meeting the goals of the October 28, 2011, Presidential Memorandum, Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses. The memorandum calls for agencies to establish goals and measure performance, streamline administrative processes, and facilitate local and regional partnerships. As part of the effort to streamline administrative processes and speed up the transfer Reclamation's technologies, Reclamation has delegated authority for signing technology transfer agreements to the Chief of Research and Development.

Partnership Intermediary Agreement to Advance Reclamation's Transfer of Technologies

In September 2014, Reclamation entered into a Partnership Intermediary Agreement, as authorized by 15 USC 3715, with the Center for Innovation (CFI), LLC, in Arlington, Texas, to assist Reclamation in its technology transfer efforts. Partnership Intermediary Agreements allow Federal research agencies to enter into an agreement with a partnership intermediary, a non-profit organization or an agency of a State or local government, to assist the Federal agency with its technology transfer activities. Under this agreement, CFI will help promote and facilitate cooperative research partnerships and expand the transfer of technology between Reclamation, other Federal laboratories, and the private sector.

Currently, CFI already serves as a partnership intermediary to other Federal agencies including the U.S. Department of Agriculture, U.S. Department of Defense, and others.

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The agreement with CFI can benefit Reclamation in several ways. For example, it can assist Reclamation in identifying and facilitating potential cooperative research partnerships with the private sector early in the research process, where the private sector plays a significant role in manufacturing and supplying the end product. Therefore, entering into cooperative research efforts with the private industry can offer multiple advantages to Reclamation. For example, private industry can:

- Share the cost of the overall research effort
- Help expedite and guide the laboratory-to-market research process
- Advise on the need to patent intellectual property in the U.S. and other countries

These cooperative research efforts can also increase the likelihood that Reclamation's research solutions will reach a broader user base that can benefit from applying the results of its research.

The agreement with CFI is also aligned with the directions established for Federal agencies to increase transfer of technologies through local and regional partnerships in the October 2011 Presidential Memorandum, Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses.

FY 2015 Initiatives

The U.S. Department of the Interior's new Technology Transfer Policies and Procedures Departmental Manual (761 DM 1) was released on May 16, 2014. In response to this new release, the Research and Development Office will be drafting associated Reclamation Directives and Standards (D&S). The D&S will be aimed at maximizing the benefits that these authorities can provide to Reclamation, Reclamation customers and stakeholders, the American public, and our national economy.

Technology Transfer Resources and Training **Federal Networking and Training:**

- Federal Laboratory Consortium (FLC) for Technology Transfer, www.federallabs.org
- Federal Technology Transfer Legislation and Policy, The Green Book, <http://www.federallabs.org/flc/store/greenbook/>
- National Institutes of Health (NIH) Online Technology Transfer Training, <http://ttraining.od.nih.gov/>

Non-Federal Networking and Training:

- Association of University Technology Managers (AUTM), www.autm.net
- Licensing Executives Society (LES), www.lesusacanada.org



Research and Development Office Technology Transfer Research Coordinator



303-445-2126
szhang@usbr.gov

Samantha Zhang is the Research and Development Office's Technology Transfer Research Coordinator for Reclamation. Prior to working at Reclamation, Samantha was at the Office of the Inspector General, Department of Justice in 2004 until 2006.

Samantha was born in the Guangdong Province of China and immigrated with her family to Denver, Colorado, in 1985. She received a Chancellor Scholarship to the Daniels College of Business at the University of Denver and graduated with honors with a Bachelors of Science in Business Administration.

Technology Transfer

The process of disseminating scientific and technical information, technologies, and other resources so that they are available for use.



Communication & Information Systems

Research and Development Office Communication and Information Systems Coordinator



Jake Akervik
303-445-2136

jakervik@usbr.gov

Jake Akervik joined Reclamation in June 2011. Jake manages the information systems and communication and outreach programs for the Research and Development Office and Science and Technology Program. His duties include:

- Designing and administrating several research management information systems, including the internal PropC and SharePoint web applications
- Managing and implementing the annual Research Jam science need and innovation crowdsourcing event
- Managing communication and outreach strategy and products, including the Research and Development website and *The Knowledge Stream* newsletter
- Reviewing and approving annual Science and Technology Program research project management plans

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FY 2014 Highlights

The Knowledge Stream

Produced four quarterly issues of *The Knowledge Stream* newsletter, which are available on the Research and Development website at: www.usbr.gov/research/publications/newsletters.cfm.

Email Distribution Technology

Upgraded *The Knowledge Stream* newsletter email distribution technology, expanding our distribution reach while allowing our recipients to more easily control their subscription preferences.

Research Bulletins and Updates

Produced numerous *Research Updates*, which can also be found on the Research and Development website at: www.usbr.gov/research/publications/updates.cfm.

Mussels Testing Results Website

Worked closely with Technical Service Center partners in the Reclamation Detection Laboratory for Exotic Species (mussel laboratory) (www.usbr.gov/mussels) to create a secure website to share water body invasive mussels test results with the State Aquatic Nuisance Species Coordinators and other stakeholder partners in the 17 Western States. For more information, contact Joe Kubitschek, Research and Development Office's Invasive Mussels Research Coordinator or Denise Hosler in the mussel laboratory. See the "Invasive Mussels" segment in this issue.

— continued from left sidebar

- Improving efficiencies and collaboration through the application of project management principles and web 2.0 technologies

Prior to joining Reclamation, Jake worked for the Minnesota Department of Transportation's Office of Policy Analysis, Research and Innovation, where he served as the Communication Coordinator, and then as a Flagship Initiative Project Manager for enterprise IT, social media, crowdsourcing and collaboration policy, and technology implementation efforts.

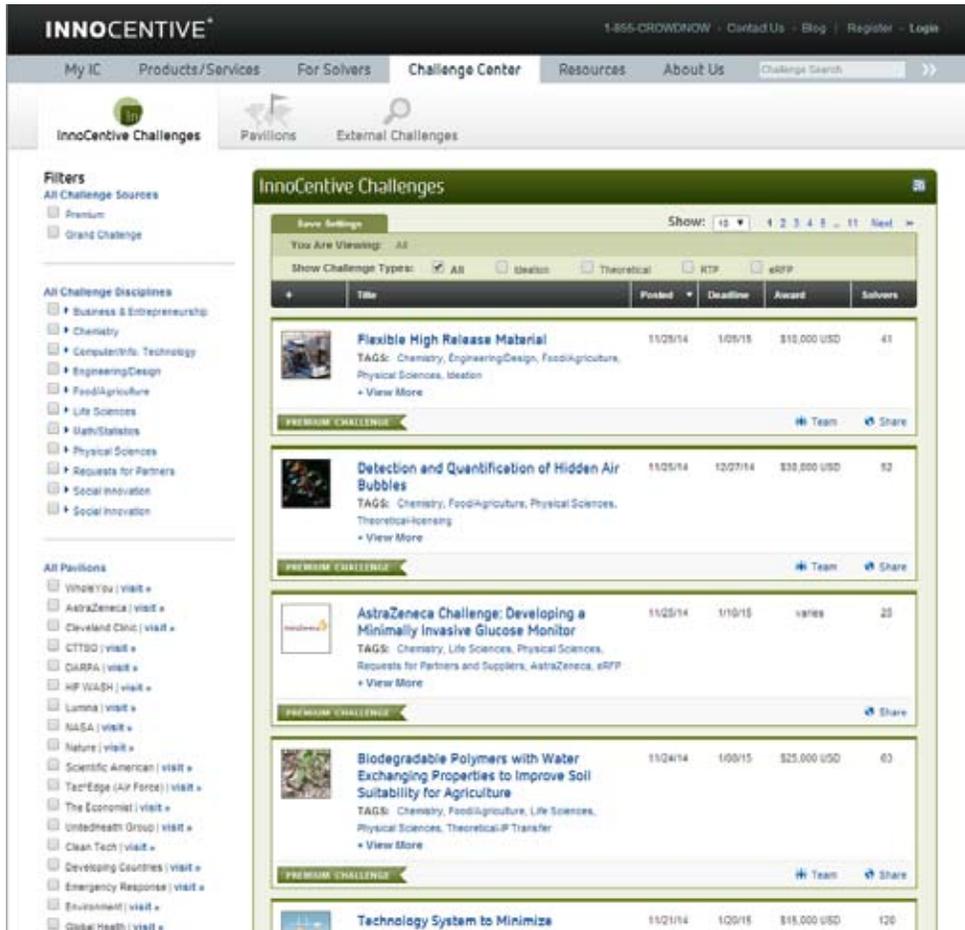
Jake graduated from the University of Minnesota in 2006 with a Bachelors of Science in Scientific and Technical Communication. He also holds an Associate's Certificate in Project Management from The George Washington University School of Business, and a Project Management Professional Certification from the Project Management Institute. He is currently pursuing a Master's degree in Technology Management at the University of Denver.



FY 2015 Initiatives

Technology Prize Challenges

Will work closely with cross-agency challenge teams and Reclamation's Public Affairs Office to produce communication plans for the future Water Prize Competition Center (www.usbr.gov/research/challenges). See the challenges webinar video at <https://attendee.gotowebinar.com/recording/258059040088445963>, and page 10 for more information on the fiscal year 2015 challenge competitions.



The screenshot shows the InnoCentive website interface. At the top, there's a navigation bar with 'My IC', 'Products/Services', 'For Solvers', 'Challenge Center', 'Resources', and 'About Us'. Below this, there are search filters for 'Show Challenge Types' (All, Ideas, Theoretical, RFP, eRFP) and a table of challenges. The table has columns for Title, Posted, Deadline, Award, and Solvers. Three challenges are visible:

Title	Posted	Deadline	Award	Solvers
Flexible High Release Material TAGS: Chemistry, Engineering/Design, Food/Agriculture, Physical Sciences, Ideation + View More	11/25/14	1/5/15	\$10,000 USD	41
Detection and Quantification of Hidden Air Bubbles TAGS: Chemistry, Food/Agriculture, Physical Sciences, Theoretical/Licensing + View More	11/25/14	12/7/14	\$30,000 USD	52
AstraZeneca Challenge: Developing a Minimally Invasive Glucose Monitor TAGS: Chemistry, Life Sciences, Physical Sciences, Requests for Partners and Suppliers, AstraZeneca, eRFP + View More	11/25/14	1/15/15	varies	23

The InnoCentive Challenge Center, where Reclamation challenges will be posted in FY 2015 (www.innocentive.com/ar/challenge/browse).

Ideation and Crowdsourcing

Will look at options to expand the annual Reclamation Research Jam (see right sidebar) to external stakeholders in order to increase the number and quality of Reclamation's research needs and ideas. Stay tuned for more information.

Knowledge Transfer

Will continue to increase efforts to improve the close out process of research projects in their final year, which includes production of more final project reports that are catalogued by the Reclamation Library (www.usbr.gov/library) and published on the Research and Development website at:

www.usbr.gov/research/publications/science-technology.cfm?start=2014.



Reclamation Research Jam 2015 Coming Soon! 2014 Review and 2015 Preview

The Research and Development Office hosted the Third Annual Research Jam in February 2014, an internal science and research idea crowdsourcing event. A recap can be found in the Spring 2014 issue of *The Knowledge Stream* at:

www.usbr.gov/research/docs/ks/2014-03-ks.pdf

The 2015 Research Jam is scheduled for March 2015—from March 2 through March 27, 2015. Stay tuned to your email and the Research and Development website for updates.



Curt Brown, former Chief of Research and Development, presenting Bobbie Jo Merten with the 2014 Research Jam People's Choice Award for her winning idea: "Life After Coal Tar Enamel - New Long-Term Protective Coatings."



U.S. Department of the Interior
Bureau of Reclamation

Recent Research Products

To get the information generated by research quickly into the hands of end users and the broader public, our researchers and partners publish their results in peer-reviewed journals, technical memoranda, research reports, and other venues.

Contact the authors/principal investigators for information about these documents or research projects. Use the Science and Technology Program research project ID number to access contact information or the documents themselves at:

www.usbr.gov/research/projects/search.cfm.

Report on Fire Protection Systems

By Ron LeBlanc

Project ID 6002

Upload Date 12-30-2014

Preliminary Chemical Shrinkage Analysis of Nano Silica Cementitious Binders

By John Bret Robertson

Project ID 4967

Upload Date 12-16-2014



Literature Review: Potentiodynamic Polarization Testing to Confirm the Suitability of Zinc Anodes in Natural Waters Specific to Reclamation

By Roger Turcotte

Project ID 6793

Upload Date 12-16-2014

Impact of Quagga on Reservoir Water Quality

By Mike Horn

Project ID 3318

Upload Date 12-15-2014

Impacts of Quagga Mussels on Particulate Organic Matter

By Mike Horn

Project ID 3997

Upload Date 12-15-2014

Exploring Methods to Predict, Manage, and Control Alluvial Material Transport

By Carrie Scott

Project ID 7796

Upload Date 12-15-2014

Nitrogen Effects in Western Riparian Areas

By Douglas Andersen

Project ID 15

Upload Date 12-12-2014



Is Detection of Long-Term Impacts Using Aquatic Macroinvertebrates Seasonally Dependent?

By Mark Nelson

Project ID 8224

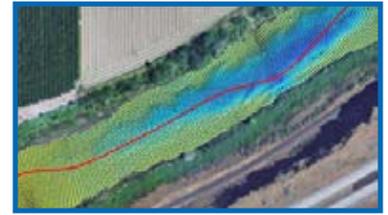
Upload Date 12-12-2014

Development of Automated Methods to Improve Surface Modeling of River Channel Geometry and Features

By Kurt Wille

Project ID 2834

Upload Date 12-12-2014



Assessing and Reducing the Uncertainty of Predictions From Hydraulic and Hydrologic Models

By Jeff Niemann

Project ID 9320

Upload Date 12-12-2014

Testing Ecological Tradeoffs of a New Tool for Removing Fine Sediment in a Spring-Fed Stream

By Laurie Marczak, Juddson Sechrist, and Adam Sepulveda

Project ID 2249

Upload Date 12-12-2014

This document contains protected information and it cannot be freely downloaded from USBR.gov. Contact the author/principal investigator to request a copy of this document.

Identification of Unknown Organisms by DNA Barcoding: A Molecular Method for Species Classification

By Jacque Keele

Project ID 45

Upload Date 12-12-2014



Predicting Total Dissolved Gas (TDG) for the Mid-Columbia River System

By Boualem Hadjerioua, Marcela Politano, Scott DeNeale, Merlynn Bender, and Alejandro Castro

Project ID 9650

Upload Date 12-12-2014

Concrete Core Logging App

By Audrey Rager

Project ID 5481

Upload Date 12-12-2014

Optimization of Early Detection of Quagga Mussels by Polymerase Chain Reaction

By Jacque Keele

Project ID 3688

Upload Date 12-12-2014

Improving Concrete Longevity and Durability: Lessons From Roman Concrete

By Audrey Rager

Project ID 7137

Upload Date 12-12-2014



Forecasting Crop Irrigation Water Requirements

By Cameron Bracken, Subhrendu Gangopadhyay, and Tom Pruitt

Project ID 1472

Upload Date 12-08-2014

Evaluation of Parameter and Model Uncertainty in Simple Applications of a 1D Sediment Transport Model

By Shaina Sabatine, Jeff Niemann, and Blair Greimann

Project ID 9320

Upload Date 12-05-2014

Moisture Content Requirements for Repair, Part 1:

Concrete Repair Testing

By Benoit Bissonnette, Kurt Von Fay, and Alex Vaysburd

Project ID 6629

Upload Date 12-04-2014

Installation of Impact Plates to Continuously Measure Bed Load: Elwha River, Washington, USA

By Robert Hilldale, Wayne Carpenter, Bradley Goodwiller, Jim Chambers, and Tim Randle

Project ID 115

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The coatings laboratory within the Materials Engineering and Research Laboratory in Reclamation's Technical Service Center.



Salt water bath in the coatings laboratory.

Coated steel coupons hanging up to dry.



Coatings Group Research and Capabilities
See the "Research Spotlight—Coatings" segment on page 37.



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