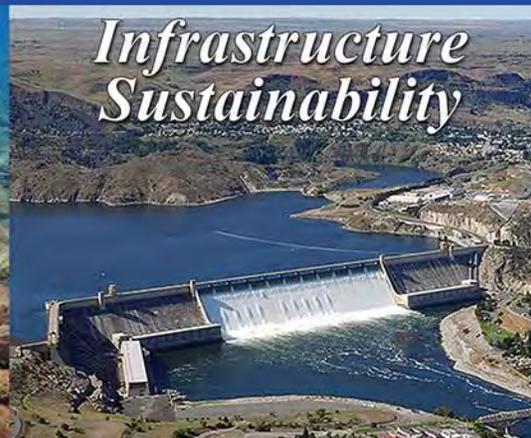
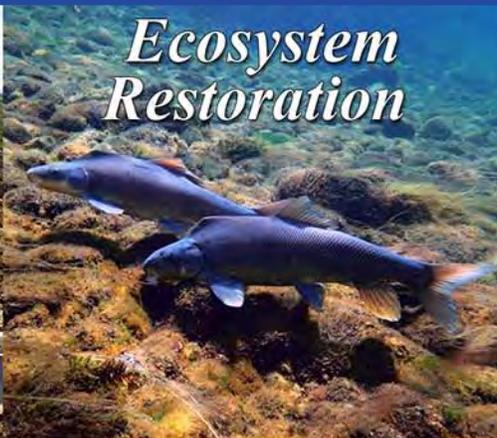
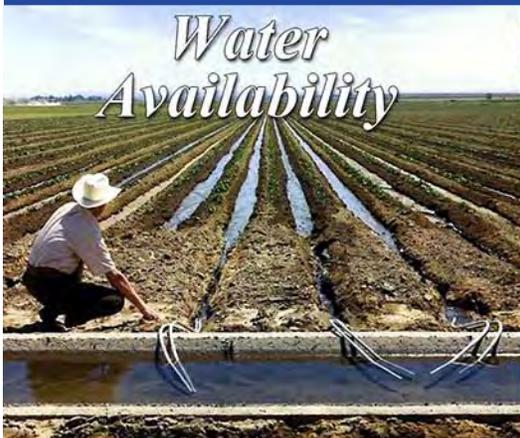


Winter 2015-2016  
Research and  
Development Office  
Newsletter 2016-01

## The Knowledge Stream

### Water Technology Prize Competitions Issue



### How It Works

This newsletter is available at:  
[www.usbr.gov/research/docs/ks-2016-01.pdf](http://www.usbr.gov/research/docs/ks-2016-01.pdf)  
To subscribe to this newsletter,  
see page 3.

Challenge.gov is open innovation and crowdsourcing competition for all!



Federal agencies are inviting you to come up with the best ways to solve problems and innovate together.



# WATER

PRIZE COMPETITION CENTER



ELECTRICAL BARRIERS—A  
NEW WAY TO KEEP FISH ON  
TRACK

CHALLENGE.GOV: A NEW WAY  
FOR EVERYONE TO WIN

RECLAMATION'S STRATEGY:  
DEVELOPING CAPABILITIES  
AND IMPLEMENTING PRIZE  
COMPETITIONS

THE DESAL PRIZE  
FOLLOWUP—CONCEPTS  
FROM THE DESAL PRIZE GO  
GLOBAL

# Chief's Message

## Research and Development Office Contact Information

Levi Brekke  
Chief of Research  
303-445-2494, lbrekke@usbr.gov

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

John Whitley  
Science and Technology  
Program Manager  
303-445-2241, jwhitley@usbr.gov

Ronda Dorsey  
Communication and  
Information Systems Coordinator  
303-445-2624, rdorsey@usbr.gov

Jennifer Arends  
Budget Analyst  
303-445-2231, jarends@usbr.gov

Janet Barday (Formerly Montano)  
Administrative Assistant  
303-445-2133, jbarday@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

Denise Hosler  
Invasive Mussels  
303-445-2195, dhosler@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

*continued in right sidebar*

Hello and welcome to the Winter 2015-2016 edition of *The Knowledge Stream* quarterly! In this issue, you can learn about Research and Development Office (Research Office) efforts to host technology prize competitions and enlist “citizen solvers” to help address some of the most difficult water and power management challenges facing Reclamation and its customers and stakeholders. You will also find articles covering a variety of program activities, including technology transfer and results from recently completed research and development projects.

This edition spotlights the Research Office’s growing efforts to use technology prize competitions to spur innovation by engaging a non-traditional, national solver community. Competitions complement traditional research as they are designed to target our most persistent science and technology challenges where traditional research pathways have led to limited progress. Competitions also involve using prizes to incentivize submission of solutions and are made open to a national, non-Federal solver community including citizens, businesses, and other organizations. Making these competitions available to a broad solver base will help access solutions from non-traditional sources. Leveraging online competition platforms is key to this endeavor. Coupling prize competitions with an online global community provides a wonderful tool to capitalize on the principle that “no matter who you are, most of the smartest people work for someone else” (attributed to Sun Microsystems, Inc., co-founder Bill Joy).

In this issue, you will read about how the Research Office is collaborating with Reclamation’s Technical Service Center, regions, and other members of the Federal water science and management community to develop, design, and host competitions that address water and power management challenges. Competitions are being designed in three challenge theme areas: Water Availability, Ecosystem Restoration, and Infrastructure Sustainability. You will also read about some of Reclamation’s early prize competition experiences related to advancing clean water technology and providing greater fish recovery opportunities by improving methods to track fish and fish “food” migration in rivers. Lastly, you will learn about how you can get involved in Reclamation’s Water Prize Competition Center, and online sites sponsored by collaborators at InnoCentive and Challenge.gov— we hope you enjoy!

*Levi Brekke*  
*Chief of Research*

**Chuck Hennig,**  
**Deputy Chief of Research,**  
**served as principal editor for this issue.**



# Contents

**In this Issue . . .** (page 1)

**Chief's Message** (page 2)

**Innovation Around Reclamation:**

2015 Reclamation Intern Poster Contest (page 4)

Electrical Barriers—A New Way to Keep Fish on Track (page 5)

**What Are Prize Competitions?** (page 6)

**Featured Faces:**

Ian Ferguson, Hydrologic Engineer (page 8)

Andrew Tiffenbach, Mechanical Engineer (page 8)

Mark McKinstry, Biological Scientist (page 9)

Connie Svoboda, Hydraulic Engineer (page 10)

Joshua Israel, Fish Biologist (page 10)

Bobbi Jo Merten, Chemist (page 11)

**Multimedia Around Reclamation**

Reclamation's Water Prize Competition Center (page 12)

Prize Competitions in the Federal Government (page 13)

**Open Innovation: A Flexible Tool for Solving Problems** (page 14)

**Open Innovation Events: Reclamation's Prize-Winning Performances**

All Hands on Deck: Solving Complex Problems Through Prizes and Challenges (page 16)

Five-Year Anniversary of Challenge.gov (page 16)

Five Years of Excellence in Federal Challenge & Prize Competitions Awards (page 16)

**Reclamation's Strategy: Developing Capabilities and Implementing Prize Competitions** (page 18)

**Forging Partnerships** (page 20)

**Water Prize Competition Center Training** (page 21)

**Water Prize Competition Center Theme Areas and Prize Competitions:**

Water Availability (page 22)

Ecosystem Restoration (page 23)

Infrastructure Sustainability (page 24)

**Reclamation's First Prize Competition: New Concepts for Remote Fish Detection** (page 25)

**Reclamation's Second Prize Competition: Quantifying Drift Invertebrates in River and Estuary Systems** (page 27)

**Challenge.gov: A New Way for Everyone to Win** (page 28)

**The Desal Prize Followup—Concepts From the Desal Prize Go Global** (page 30)

**Lessons Learned** (page 32)

**Research Updates Contents:** (page 33)

Visualizing Salinity in the San Joaquin River (page 34)

Forecasting Extreme Flooding Events (page 36)

Treat Impaired Water or Import Fresh Water? (page 38)

Solar Photovoltaic Desalination Using Distillation (page 40)

**Water Prize Competition Center—Launch Calendar** (page 42)

## Research and Development Office Deputy Chief of Research



*Chuck Hennig*

303-445-2134, [chennig@usbr.gov](mailto:chennig@usbr.gov)

Chuck Hennig graduated from the Colorado State University in 1978 with a Bachelors of Science in Civil Engineering and started his career with Reclamation in 1979. 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.

—continued on page 18

## Research and Development Office Contact Information

**Website:**

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

**Sign Up to Receive  
The Knowledge Stream. . .**

<http://bit.ly/1Cbmv5V> or  
<http://tinyurl.com/ks-signup>



U.S. Department of the Interior  
Bureau of Reclamation

Reclamation's Searchable  
Telephone Directory:  
[www.usbr.gov/phonebook](http://www.usbr.gov/phonebook)

# Innovation Around Reclamation



*Student interns presenting their posters at the Second Annual Reclamation Intern Poster Contest in Denver, Colorado.*

Congratulations to the winners and to all the student interns for sharing their work and making the poster contest such a success! A big “thank you” also goes out to the Reclamation staff that volunteered as judges and to the student intern mentors for their summer-long commitment to developing the skills of these young engineers.

## 2015 Reclamation Intern Poster Contest

The Second Annual Reclamation Intern Poster Contest was held on July 23, 2015, at Reclamation’s Technical Service Center in Denver, Colorado. Twenty-three students prepared and presented posters based on some aspect of their summer internship work at Reclamation.

Topics ranged from laboratory materials testing, security requirements, and invasive mussels to all aspects of Reclamation project engineering work and more. The prize for Best Poster Presentation was awarded to Juan Vela for his poster on “Whiskeytown Dam Intake Structure Bulkhead.” Zach Jordan won Best Printed Poster for “Passivation of Zinc Anodes in Natural Freshwaters.” The Student Choice Award—a new award requested and voted on by the student interns themselves—was presented to Prospero Gonzalez for “Arkansas Valley Conduit.”



*Winning student interns, from left to right: Prospero Gonzalez, Juan Vela, and Zach Jordan.*



*The 23 student interns that prepared and presented posters at the Second Annual Reclamation Intern Poster Contest in Denver, Colorado.*

Winning posters will be reprinted and displayed in Building 56 of Reclamation’s Denver Office, Colorado, for the upcoming year.

The student interns that participated in this year’s contest were (in alphabetical order): Riley Bair, Matthew Becker, Marianna Brown, Maria De la Piedra Yanes, Prospero Gonzalez, Scott Haisma, Christian Hernandez, Lora Hoopes, Nick Jones, Zach Jordan, Katie Kerstiens, Keturah Kiper, Scott Monesmith, Kerry Muenchow, Jachin Myers, Samantha Prince, Jeremy Schuster, Logan Thompson, Mark Travers, Juan Vela, Ariel Voit, James Waller, and Kelsi Whitesell.

Contact: Jessica Torrey | Technical Service Center | 303-445-2376 | [jtorrey@usbr.gov](mailto:jtorrey@usbr.gov)



U.S. Department of the Interior  
Bureau of Reclamation

## Electrical Barriers—A New Way to Keep Fish on Track

California's Central Valley fall-run Chinook salmon are listed as a species of special concern under the Endangered Species Act. Claimants suggest a portion of the fall-run Chinook salmon introduced from the Mokelumne River Fish Hatchery do not return to their prenatal system, but stray into the Sacramento River and, ultimately, tributaries of the Sacramento River.

The Delta Cross Channel (DCC) and associated gates are roughly 30 miles south of Sacramento, California, near Walnut Grove. They operate to maintain salinity standards at the Central Valley Project and State Water Project. When the gates are open, fresh water is drawn from the Sacramento River into the Sacramento/San Joaquin Delta via the Mokelumne River.

However, open DCC gates and diverted Sacramento River flows may attract adult Mokelumne River origin fall-run Chinook salmon away from their prenatal spawning grounds into the Sacramento River system and major tributaries (i.e., American River). Experimental DCC gate closures in 2010 and 2011, resulting in reduced straying into the American River by over 50 percent, suggest traversing through the DCC likely contributes to straying. However, closing the gates prevents boat access and prevents fresh water from entering the Sacramento/San Joaquin Delta.

The Central Valley Project Improvement Act (CVPIA) (Reclamation, U.S. Fish and Wildlife Service, California Department of Water Resources, and California Department of Fish and Wildlife) is sponsoring a project suggested by the Golden Gate Salmon Association. The contractor, Smith-Root, Inc., is designing an instream electrical barrier system to keep the DCC operating during salmon migration, minimizing straying of adult salmon. This electrical barrier is proposed for testing to determine its effectiveness in ensuring adult upstream migrating Chinook salmon use the Mokelumne River rather than straying into the Sacramento River through the DCC.

The DCC Graduated Field Fish Barrier (GFFB) is the CVPIA's first attempt to use this technology in the Sacramento/San Joaquin Delta. The GFFB will be custom-designed for a specific location in the DCC and, if successful, could prove useful in other Reclamation applications. An electrical fish barrier can be thought of as an impassible barricade that is controlled, directed, and confined. The barrier will be designed to produce an electrical field that will increase discomfort in fish as they near the barrier. It will be remotely monitored with telemetry, modems, hydroacoustics, and sensors, and likely debris free. Proving this technology application is important to Reclamation's future efforts to manage salmonid fish interaction with Central Valley Project facilities.

Contact: Rod Wittler | Mid-Pacific Region | 530-262-3670 | [rjwittler@usbr.gov](mailto:rjwittler@usbr.gov)



California's Central Valley fall-run Chinook salmon.



Delta Cross Channel gates in the closed position, California.

***“Building experience with electrical barriers is important for Reclamation. If the technology proves to be effective for keeping the Delta Cross Channel gates open while ensuring human safety and guiding salmon migration, other facilities might wish to adapt similar techniques.”***

Rod Wittler  
Fish Resource Area Coordinator,  
Reclamation's Mid-Pacific Region

### More Information

As part of this effort, Reclamation's Science and Technology Program is supporting a multiyear effort to evaluate salmon migration before and after the barrier is installed.

This research project just completed the first year of baseline monitoring (pre-installation), including using hydroacoustic and DIDSON cameras (in both channels leading to the DCC gates).

Acoustic transmitters were implanted in or surgically attached to adult fall-run Chinook salmon in September through November 2015. Data are used to quantify movements of fall-run Chinook salmon through the DCC. Data post-processing and summarization for this effort will occur this winter.

Future planned efforts include one additional year of pre-treatment monitoring, followed by at least 1 year of evaluating treatment (electrical barrier) effects.

See: [www.usbr.gov/research/projects/detail.cfm?id=554](http://www.usbr.gov/research/projects/detail.cfm?id=554)



# What Are Prize Competitions?

Prize competitions are partnerships that reach out to solvers—individuals, businesses, universities, and other organizations—to solve problems. For solvers, prize competitions are an opportunity to get creative and earn money by creating knowledge or applying existing knowledge in novel ways. Advantages for solvers include:

- Make a positive impact
- Exercise your brain
- Promote yourself
- Earn awards

For more information, see InnoCentive's "For Solvers" website at:

[www.innocentive.com/for-solvers/why-solve](http://www.innocentive.com/for-solvers/why-solve)



*Napoleon/Food Preservation Prize.*

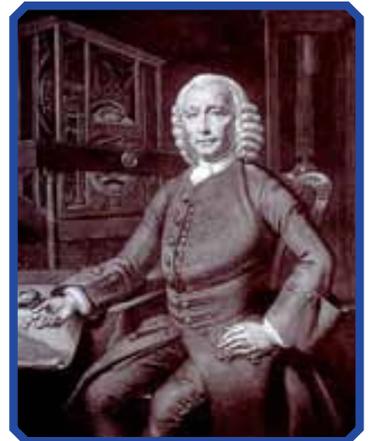


*SpaceShipOne/  
Ansari X-Prize.*

Somewhere out there, someone has the answers. Is there a more accurate and easier way to track fish? Is there a more effective and inexpensive method to turn brackish or ocean water into drinking water? Finding these people with the answers just got easier—Federal agencies now have an exciting tool to invite the public and private sectors to come and work with Reclamation to solve problems that are important to Reclamation's mission. The prize competition authorities section included in the America COMPETES Reauthorization Act of 2010 (15 USC 3719) authorizes all Federal agencies the option to use prize competitions as an additional tool to find solutions to the problems they need to solve.

Prize competitions allow governments to focus on the difficult, persistent problems—research communities have made progress, but wider, community-based prize competitions could lead to even more breakthroughs. Prize competitions allow agencies to seek new and timely solutions from beyond the usual sources of potential solvers and experts. The potential solvers also now have new ways to shout out their solutions beyond the standard contractual methods.

For centuries, prize competitions have helped expand frontiers, reach new heights, and address the challenges of every age. The British Government launched the Longitude Prize in 1714, gaining an accurate marine navigation method developed by a clockmaker, John Harrison. Napoleon found a way to preserve food for his troops in the field by issuing the Napoleon Food Preservation Prize in 1795. Charles Lindberg won the Orteig Prize in 1927 by being the first to fly across the Atlantic Ocean. The Orteig Prize was sponsored by the New York hotel industry to help open oversea markets. The Ansari X-Prize, run by the X-Prize Foundation, catalyzed the private space flight industry in 2004.



*John Harrison/Longitude Prize.*



*Charles Lindberg/Orteig Prize.*

With the world now connected through the Internet, many online crowdsourcing platforms now exist to connect those that have problems with those that can help solve problems. Over the past 15 years, using these platforms by the private sector to solve problems has increased dramatically. Prize competitions coupled with the world connected through the Internet provides a wonderful tool to capitalize on Joy's Law—the principle that "no matter who you are, most of the smartest people work for someone else" (attributed to Sun Microsystems, Inc., co-founder Bill Joy). Since 2010, Federal agencies have been joining the parade to team up with the smart people outside their organizations to help address complex challenges through prize competitions.

## Got a Problem?

- Tell the world about it and what a winning solution would have to do
- Challenge anybody in the world to bring you that winning solution
- Add a monetary and/or non-monetary prize to incentivize the competition
- Launch the prize competition, see what you get, and make awards accordingly
- If nobody is able to solve your problem, no prize payments are required

Problems that are typically better suited for solving through prize competitions are those where:

- An adequate or strong solution has been evasive or expensive.
- You find yourself saying that somebody, somewhere probably knows a better way of doing this.
- Market forces may not provide appropriate incentives to solve, or solve well.
- You would like to reach beyond the usual sources of potential solvers and experts that commonly work in your domain.
- You do not know the area or realm very well and you do not know how to get the best capabilities to think about or work on your problem.
- You would like to jump-start your research project by augmenting your literature search with a prize competition to gather good ideas or see what else exists.
- You would like to see if anybody can help you solve a tough, complex element that is bogging down your overall research project.

## How Does Reclamation Select Topic Ideas for Prize Competitions?

The Research and Development Office is collaborating with Reclamation's TSC, regions, and other members of the Federal water science and management community to develop, design, and host prize competitions that address water and power management challenges. Prize competition topics are suggested by Reclamation and other agency representatives participating in each of three theme areas comprising Reclamation's Water Prize Competition Center—Water Availability, Ecosystem Restoration, and Infrastructure Sustainability. Top candidate topics are those topics that are shared priorities of Reclamation and one or more collaborating Federal agencies.

Reclamation priorities are steered by the priority needs voiced by Reclamation resource managers participating in a specific theme area. Reclamation wants to solve problems in the areas where resource managers want new and better solutions, and these are the people with the authority and responsibility to implement them. The problem should also be well suited for the prize competition business model to be included in the top candidate topics list. The topics Reclamation actually selects from the top candidate lists are typically those topics that are able to form and schedule a willing and able multiagency team to design and judge the competition within available funding resources.

## More Information

To learn more about what Federal agencies are doing with prize competition authorities, visit:

[www.Challenge.gov](http://www.Challenge.gov)

To learn more about prize competitions, suggested references include:

- **Challenge Prizes: A Practice Guide by NESTA**

[www.nesta.org.uk/publications/challenge-prizes-practice-guide](http://www.nesta.org.uk/publications/challenge-prizes-practice-guide)

- **The Craft of Incentive Prize Design, Lessons From the Public Sector**

<http://dupress.com/articles/the-craft-of-incentive-prize-design>

Federal Government employees as well as the public can submit topic ideas for consideration as prize competitions through Reclamation's Water Prize Competition Center website at: [www.usbr.gov/research/challenges](http://www.usbr.gov/research/challenges)



# Featured Faces

## Water Prize Competition Center Theme Area: Water Availability Ian Ferguson, Hydrologic Engineer

Ian Ferguson is a hydrologic engineer in the Water Resources Planning and Operations Support Group in Reclamation's Technical Service Center in Denver, Colorado. He earned his Bachelors of Science in Civil and Environmental Engineering from Princeton University in Princeton, New Jersey.

After receiving his bachelor's degree, Ian worked for an environmental consulting firm in San Francisco, California, before continuing his education at the University of California at Berkeley, where he earned his Masters and Doctorate in Civil and Environmental Engineering. Ian's graduate research focused on the relationships between the physical processes and stochastic characteristics of climate variability and change, with an emphasis on understanding and predicting multiyear drought events. His graduate research was supported by a fellowship at Lawrence Livermore National Laboratory. After completing his doctorate, Ian took a postdoctoral research fellowship at the Colorado School of Mines, in Golden, Colorado, where his research focused on developing improved modeling methods for simulating groundwater and surface water hydrology and applying these methods to evaluate anthropogenic impacts on the hydrologic cycle, including effects of water management and climate change.



*Ian Ferguson*

Since Ian joined Reclamation's Technical Service Center in 2011, he has worked on a variety of technical studies to support water resources planning and operations across the West. His work includes developing, testing, and applying hydrologic and water resources operations models to analyze current and future water supplies, demands, and operations. In addition to his project work, Ian has lead research studies focusing on the use of hydrologic models and climate projection information to support long-term water resources planning. In addition, Ian is co-managing the portfolio of prize competitions under the Water Availability theme area of Reclamation's Water Prize Competition Center, specifically managing and focusing on competitions that address current challenges in monitoring and predicting water supplies and demands, improving water operations, and water conservation. His research background and broad project experience provide a solid foundation for coordinating with others in Reclamation and collaborating Federal agencies to identify critical challenges and pursue new and novel solutions through prize competitions.

Outside of work, Ian spends most of his time exploring the Front Range and beyond with his family. He and his wife are having a blast introducing their son to camping, hiking, biking, climbing, paddling, and skiing in the Rockies. When they need a break from the mountains, they retreat to their home away from home in Baja California Sur to relax and enjoy a different flavor of outdoor fun.



*Andrew Tiffenbach*

## Water Prize Competition Center Theme Area: Water Availability Andrew Tiffenbach, Mechanical Engineer

Andrew Tiffenbach is a mechanical engineer in the Water Treatment Group in Reclamation's Technical Service Center in Denver, Colorado. Andrew has a Bachelors of Science in Mechanical Engineering and a Masters of Science in Engineering and Technology Management, both from the Colorado School of Mines in Golden, Colorado. Andrew began working for Reclamation as a student in 2003, where he assisted with operating a water treatment pilot plant in Mesquite, Nevada, and designing and modeling evaporation ponds for the San Luis Unit of the Central Valley Project.

Since joining Reclamation full time in 2005, Andrew has worked on a wide variety of research and design projects. He has operated water treatment pilot plants and research equipment in places such as Alamogordo and Gallup, New Mexico; Port Hueneme, California; and Selfridge Air National Guard Base, Michigan.

— continued

# ...Highlighting People That Contribute to Reclamation Research and Development

— continued

Andrew has led and participated in a number of preliminary, appraisal, and feasibility studies to assess how advanced water treatment can help meet water demands throughout the Western United States. Since 2011, Andrew has led and participated in Environmental Management Systems audits of regional and area offices throughout Reclamation. He is also a former member of the TSC Project Management Steering Committee, where he helped develop project management tools and training for use throughout the Technical Service Center.

Andrew recently assisted with the Desal Prize competition hosted at Reclamation's Brackish Groundwater National Desalination Research Facility in Alamogordo, New Mexico. In addition, Andrew is co-managing the portfolio of prize competitions under the Water Availability theme area of Reclamation's Water Prize Competition Center, specifically managing the Water Treatment and Water Conservation topics.

Andrew enjoys traveling, spending time with family and friends, and playing and watching sports. Andrew and his wife just welcomed their first son in July 2015.

## **Water Prize Competition Center Theme Area: Ecosystem Restoration** **Mark McKinstry, Biological Scientist**

Mark McKinstry is a biological scientist working in Reclamation's Upper Colorado Region in Salt Lake City, Utah. Mark has a Bachelors of Science in Wildlife and Fish Biology from Colorado State University in Fort Collins, Colorado. He also completed a Masters of Science in Zoology and Water Resources, as well as a Doctorate in Zoology and Statistics, both from the University of Wyoming. Mark worked as a senior research scientist at the University of Wyoming for over 10 years, where he focused on the ecology of wetlands, waterfowl, aquatic mammals, as well as the restoration of wetland and riparian areas. In 2003, Mark began his career at Reclamation, working on the Endangered Fish Recovery Programs in the Upper Colorado River Basin.



*Mark McKinstry*

Mark's work on the Endangered Fish Recovery Programs has equipped him with valuable insight and information necessary for managers to make critical decisions for managing endangered fish. Critical to these decisions is accurate, up-to-date information on population numbers, fish movement, and survival. The ability to accurately detect and identify individual fish is critical to these decisions. It drives the overall management of these species, as well as Reclamation's future river management actions.

Fish managers currently rely on a variety of marking technologies to identify individual fish, including Passive Integrated Transponder (PIT) tags, sonic tags, and telemetry tags. Each technique has its advantages and disadvantages. The Holy Grail of fish detection would be to have a system that accurately detects individual fish from more than 20 feet away and costs less than a few dollars to mark each fish. So far, the search for such a fish detection system has frustrated fish managers, physicists, electrical engineers, and even military scientists. Reclamation's first water prize competition, "New Concepts for Remote Fish Detection" was an attempt to reach out to people and organizations that Reclamation might not normally work with to identify solutions that can assist in the development of this Holy Grail.

Mark has been married for 31 years to Debbie and has one son, Scott, who enjoys outdoor sports almost as much as Mark does. In his spare time, Mark enjoys a variety of outdoor activities including whitewater rafting and kayaking, bird hunting, fishing, adventure travel to remote and wild places, and training his bird dog.

# Featured Faces

## **Water Prize Competition Center Theme Area: Ecosystem Restoration**

### **Connie Svoboda, Hydraulic Engineer**

Connie Svoboda has worked for 14 years as a hydraulic engineer in the Hydraulic Investigations and Laboratory Services Group in Reclamation's Technical Service Center in Denver, Colorado. She obtained a Bachelors of Science in Civil and Environmental Engineering from Lehigh University in Bethlehem, Pennsylvania, as well as a Masters of Science in Civil Engineering from the University of Minnesota in Minneapolis, Minnesota. As a graduate student, Connie was fortunate to work at St. Anthony Falls Hydraulics Laboratory at the University of Minnesota, which equipped her with the necessary laboratory experience to excel in her current duties in Reclamation's hydraulics laboratory. Connie is a registered Professional Engineer in the State of Colorado.



*Connie Svoboda*

Connie has been an active researcher with Reclamation's Science and Technology Program on projects related to the performance of stilling basins with stepped spillways, large woody debris for river restoration, electric fish barriers, and fish predation refugia. Her interest in identifying and researching issues that directly affect Reclamation led her to Reclamation's Water Prize Competition Center.

Connie is managing the portfolio of prize competitions under the Ecosystem Restoration theme area of Reclamation's Water Prize Competition Center, including the areas of fish recovery, sedimentation, temperature management, and invasive species. In addition, Connie works with subject matter experts within Reclamation, and other collaborating agencies, to identify challenges appropriate for prize competitions. She assists prize competition team leads on designing and judging prize competitions. Currently, Connie also serves as the prize competition team co-lead on Reclamation's third prize challenge, "Downstream Fish Passage at Tall Dams," which is expected to launch in March 2016.

Connie has seen firsthand how the Water Prize Competition Center has become an effective vehicle to promote internal discussions about Reclamation's biggest needs and challenges. She believes that if a prize competition is warranted, it can provide Reclamation with new ideas and technologies by tapping into the innovative capacity of the American public.

Connie enjoys spending time outdoors with her husband, 2-year-old daughter, and crazy dog. When Connie is not at work, you can find her biking, hiking, skiing, or exploring in the mountains.



*Josh Israel*

## **Water Prize Competition Center Theme Area: Ecosystem Restoration**

### **Joshua Israel, Fish Biologist**

Joshua Israel is a fish biologist working in the Bay-Delta Office in Sacramento, California, in Reclamation's Mid-Pacific Region. Josh has a Bachelors of Science in Biochemistry and Molecular Biology from the University of California in Santa Cruz. He also earned a Doctorate in Ecology (with an emphasis on conservation ecology) from the University of California-Davis. After completing his Ph.D. on the conservation genetics of North American green sturgeon, Josh continued as a postdoctoral researcher working on a variety of projects involving novel tools in risk assessment, telemetry, and genetic analyses in California populations of salmonids and green sturgeon.

— continued

# ...Highlighting People That Contribute to Reclamation Research and Development

— continued

In 2010, Josh joined Reclamation's Mid-Pacific Region. He continues his telemetry research and has led a collaborative study with the U.S. Fish and Wildlife Service and U.S. Geological Survey on steelhead survival and migration through the San Joaquin River and San Francisco Bay-Delta since 2011. Josh has also directed development of multiple ecohydraulic models to evaluate habitat restoration and fish passage alternatives being considered in the Lower Sacramento River. In addition to his research projects, he has led interagency teams working on the biological evaluation of real-time and seasonal operational plans for the Central Valley Project as part of Reclamation's response to California's recent drought.

Josh participated in the Technical Service Center's Ecohydraulic roadmap work team and is active in prize competition work under the Ecosystem Restoration theme area of Reclamation's Water Prize Competition Center. He is co-leading the current prize competition, "Quantifying Drift Invertebrates in River and Estuary Systems," to investigate innovative solutions for quantifying drift invertebrates to better characterize the benefits of habitat restoration to aquatic food webs. Josh would like to become more active in prize competitions created to solve challenging problems in fish recovery and habitat restoration monitoring and planning.

Josh's interests at home include gardening, yoga, and barbecuing with his family. This past summer (2015), Josh backpacked the John Muir Trail. He and his spouse spend many weekends watching their 13-year-old son and 8-year-old daughter play little league baseball or hiking, swimming, and exploring California's scenic rivers.

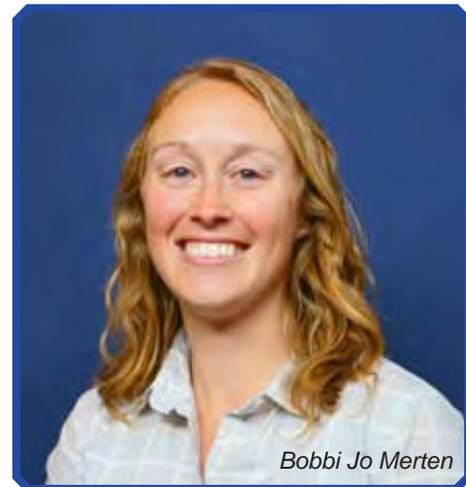
## Water Prize Competition Center Theme Area: Infrastructure Sustainability Bobbi Jo Merten, Chemist

Bobbi Jo Merten is a chemist in the Materials and Corrosion Laboratory in Reclamation's Technical Service Center. Bobbi Jo earned her Bachelors of Science in mathematics and chemistry from Marian University in Fond du Lac, Wisconsin. She also completed her Doctorate in Coatings and Polymeric Materials at North Dakota State University in Fargo, North Dakota. She joined Reclamation in 2012 and is a National Association of Corrosion Engineers (NACE) Coatings Inspector Level 2 and NACE Cathodic Protection Tester.

Bobbi Jo assists Reclamation in corrosion prevention and control systems for its structures and equipment with a primary focus of protective coatings maintenance. She has led several research projects for Reclamation's Science and Technology Program in improved coating maintenance planning, quagga mussel mitigation, and longer service life coatings as well as the project, "Infrastructure Research Roadmapping." This latter project evaluates Reclamation's complex infrastructure to identify and prioritize outstanding research needs. This role led to greater involvement with Reclamation's Research and Development Office and the U.S. Army Corps of Engineers.

Bobbi Jo is co-managing the portfolio of prize competitions under the Infrastructure Sustainability theme area of Reclamation's Water Prize Competition Center, specifically in the areas of hydropower generation facilities, geotechnical infrastructure, and concrete and steel infrastructure. Potential prize competition topic ideas include better ways to detect internal erosion and long-term corrosion protection of existing steel structures. Her experience will aid in topic idea prioritization and development as well as the organization of prize competition design team members and judges. Cross-governmental collaboration will be a key to this success.

Bobbi Jo enjoys hiking, gardening, cooking, backpacking, and vacationing with her friends, family, and partner, Sam. In September 2015, she was inducted into her college's Hall of Fame for her athletic achievements in their NCAA Division III Softball, Basketball, Soccer, and Golf Programs.



# Multimedia Around Reclamation



## Reclamation's Water Prize Competition Center

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

### **Infrastructure Sustainability Overview**

A safe, well-maintained, and reliable inventory of dams, pipelines, hydropower generation facilities, canals, and levees is key to making water available to meet the needs of the Western United States and our Nation as a whole.

Published on October 21, 2015.

See: [www.youtube.com/watch?v=r-2WzAJ92y4](http://www.youtube.com/watch?v=r-2WzAJ92y4)



### **How Much Food is Available for Fish Species?**

Millions of dollars are spent every year on habitat restoration, improvement, and creation in rivers, streams, and estuaries. To design and evaluate the effectiveness of these habitat manipulations, scientists look at the production of food resources, such as drift invertebrates and zooplankton, that are critical food sources for fish. By understanding the amount of “fish food” available within the ecosystem, fish recovery program managers can more effectively implement and maintain critical habitat.

Published on October 7, 2015.

See: [www.youtube.com/watch?v=Y2r4BMZ80CE&index=3&list=PLvHsnLEo5Rt7SzqP6Eekoq2yFw-q1gaFm](http://www.youtube.com/watch?v=Y2r4BMZ80CE&index=3&list=PLvHsnLEo5Rt7SzqP6Eekoq2yFw-q1gaFm)

More Information: See article on page 27 in this newsletter.



### **Why is Aquatic Ecosystem Restoration Important?**

Protecting and restoring aquatic and riparian environments is vital to ensuring Reclamation watersheds are healthy and able to continue providing the water supplies that can meet the multitude of competing uses of water in the arid Western United States. Environmental and water resource managers face many difficult technical and operational challenges in their efforts to accomplish this outcome.

Published on September 9, 2015.

See: [www.youtube.com/watch?v=5X3jVeaAFTA&list=PLvHsnLEo5Rt7SzqP6Eekoq2yFw-q1gaFm&index=2](http://www.youtube.com/watch?v=5X3jVeaAFTA&list=PLvHsnLEo5Rt7SzqP6Eekoq2yFw-q1gaFm&index=2)

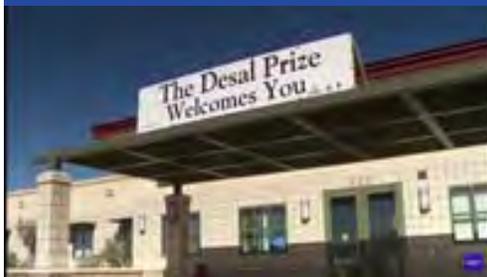


### **New Concepts for Remote Fish Detection**

The ability to track fish is central to efforts to recover threatened and endangered fish species and reduce impacts to at-risk species. Reliable, affordable detection and tracking provides vital information about how many fish are present, where and why mortality occurs, and where and why species thrive. This information enables fish recovery program managers to pursue targeted and more effective actions that can reduce mortality rates, improve habitat, and increase survival rates while continuing to meet Reclamation's mission. Published on July 20, 2015.

See: [www.youtube.com/watch?v=mCw\\_1zhLybg&index=1&list=PLvHsnLEo5Rt7SzqP6Eekoq2yFw-q1gaFm](http://www.youtube.com/watch?v=mCw_1zhLybg&index=1&list=PLvHsnLEo5Rt7SzqP6Eekoq2yFw-q1gaFm)

More Information: See article on page 25 in this newsletter.



## The Desal Prize

### **Securing Water for Food—Insider's Look at the Desal Prize**

See: [www.securingwaterforfood.org/the-desal-prize/](http://www.securingwaterforfood.org/the-desal-prize/)

### **Bloomberg Business—Burning Man for Water Geeks**

See: [www.bloomberg.com/news/videos/2015-04-24/burning-man-for-water-geeks](http://www.bloomberg.com/news/videos/2015-04-24/burning-man-for-water-geeks)



## Prize Competitions in the Federal Government

### **Challenge.gov 5-Year Anniversary**

Challenge.gov is celebrating 5 years of public-sector prize competition. See where challenge winners are today, and hear from senior agency officials on the future of open innovation and incentivized challenges. Streamed Live on October 8, 2015.

See: [www.youtube.com/watch?v=MvZMDptwpuQ](http://www.youtube.com/watch?v=MvZMDptwpuQ)

### **All Hands on Deck: Solving Complex Problems Through Prizes and Challenges Event**

October 7, 2015 videos from the morning welcome and plenary panel, prize commitments and call-to-action, fireside chat, winners and prizes, developing ambitious prizes, and moving from a culture of “problem solving” to a culture of “problem definition.” Published on October 7, 2015; Updated October 19, 2015.

See: <https://spi.georgetown.edu/prizes>

[www.youtube.com/playlist?list=PLd9b-GuOJ3nHmi8ezudkvqyEtZ3r7WB5Q](http://www.youtube.com/playlist?list=PLd9b-GuOJ3nHmi8ezudkvqyEtZ3r7WB5Q)

More Information: See article on page 16 in this newsletter.

### **Challenges (Challenge.gov) Celebrates 4 Years**

September 2014, Challenge.gov celebrated 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: [www.youtube.com/watch?v=YryUplWQDR0](http://www.youtube.com/watch?v=YryUplWQDR0)

### **OSTP’s Cristin Dorgelo on Citizen Engagement and Solving ‘Grand’ Challenges**

Cristin Dorgelo, former Assistant Director for Grand Challenges in the White House Office of Science and Technology, discusses citizen engagement and technology’s role in solving some of the Government’s most pressing challenges. Published on July 8, 2013.

See: [www.youtube.com/watch?v=mFPsIXKfgRk](http://www.youtube.com/watch?v=mFPsIXKfgRk)

### **Be the Change: Jenn Gustetic at TEDxRosslyn**

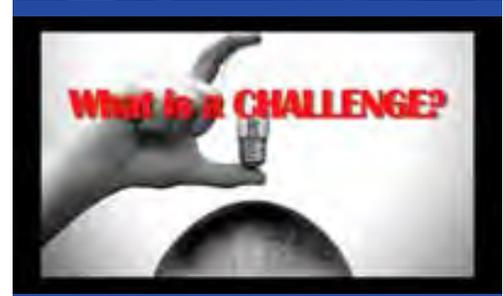
Jenn Gustetic, former Prizes and Challenges Program Executive in NASA’s Office of the Chief Technologist, discusses how people from around the world can come together to solve complex problems faced in space exploration. Gustetic points out that everyone with some coding knowledge can get involved in reimagining the future— not just the experts at NASA. Published on June 17, 2013.

See: [www.youtube.com/watch?v=ygc\\_10tDRB4](http://www.youtube.com/watch?v=ygc_10tDRB4)

### **Jenn Gustetic on Prizes and Challenges**

Jenn Gustetic, former Prizes and Challenges Program Executive in the National Aeronautics and Space Administration’s (NASA) Office of the Chief Technologist, explains how prizes and challenges offer NASA a new way to solve problems by leveraging the ingenuity of the American public, and how these challenges have produced results. Published on May 22, 2013.

See: [www.youtube.com/watch?v=zLieBIRuMDs](http://www.youtube.com/watch?v=zLieBIRuMDs)



# Open Innovation: A Flexible Tool for Solving Problems



Jennifer Gustetic

As the Assistant Director for Open Innovation in the White House Office of Science and Technology Policy, Jennifer Gustetic is scaling up open innovation approaches across the Federal Government.

Ms. Gustetic served as the National Aeronautics and Space Administration's (NASA) principal advocate, advisor, and strategist for open innovation methods, such as prize competitions and crowdsourcing.

She also led NASA's formulation efforts for its grand challenges—be bold but use achievable science, technology, and innovation goals specific enough to convey what success looks like and yet broad enough to capture our imagination.

On behalf of the Water Prize Competition Center, Reclamation's Technical Service Center interviewed Jennifer Gustetic in the Executive Office of the President of the United States, Office of Science and Technology Policy to gain more insights into how open innovation is providing solutions throughout the Federal Government.

## ***Why is Open Innovation different from other programs?***

Now, in addition to more typical tools such as grants, partnerships, and requests for proposals, managers can tailor new tools to frame questions and find answers to approach challenges creatively. Finding solvers is no longer based on past performance or past relationships, but rather is based on the integrity of the idea and potential solutions. Now, even those who are intimidated by the bureaucracy or who do not know how to navigate the process can compete. This takes away the big company mentality and provides a level playing field for all ideas and problem-solvers to come forward.

## ***Why should Federal and non-Federal entities use Open Innovation?***

Federal agencies can take a wide variety of approaches to best meet their needs in line with their objectives. The authorities to conduct prize competitions in an open innovation environment give Federal agencies a super-flexible tool where “the sky is the limit” for imaginative and creative approaches to address a wide range of tough challenges for a number of different outcomes. How you design and conduct the competition varies greatly. If you have seen one prize, you have seen only one prize.

## ***What are some of the benefits for Federal and non-Federal entities to work together on prize competitions?***

The America COMPETES Reauthorization Act of 2010 provides the authority to partner with non-governmental entities to co-fund and administer prize competitions. For example, external groups funded \$2 million in prizes for the Department of Housing and Urban Development, which led to over a billion dollars in follow-on grants to implement the ideas to rebuild public spaces after Hurricane Sandy.

## ***How can we best implement solutions to prize competitions (e.g., budget, plan for solutions)?***

Think about the goals for your competition from the very beginning. How will you use the solution? Consider the possible outcomes—often prize competitions result in even more solutions and possibilities than initially envisioned, so plan on possibilities like licensing solutions from the beginning. You can get some extra miles, but you can only implement what you set up.

Moreover, make sure that the subject matter experts, management, and other participants have bought into the challenge from the beginning, as framers and judges. Go first for the ideas that have the entire office (local and management) buy-in up front, even if these are the least exciting, as these will have the best chances for success.

## ***How can we reach a wide range of solvers in an Open Innovation environment?***

“Open Innovation” vendors can help agencies reach established communities of solvers—hundreds of thousands of people around the globe who are interested and who can solve the problems. When an agency has little experience in prize competitions, working with vendors can be a valuable training experience. Depending on the nature of a problem, open innovation vendors can help agencies get access to more eyes and more effective solvers and cut down on labor needed from agency staff for communications and marketing.

— continued

— continued

Agencies can also work through Challenge.gov and access solvers on their own, particularly if they have worked with a wide range of researchers and publics. Either way, be sure to make the commitment to engage as many potential solvers as you can—individuals, budding entrepreneurs, and other unexpected audiences can change the game for your agency.

***How would you describe the progress that Federal and non-Federal entities have made so far in conducting prize competitions and implementing solutions?***

The progress has been remarkable! Federal employees and agencies are expanding their use of prize competitions and challenges at an incredible rate. As more agencies are experimenting with this tool, they become comfortable with the process, and can address issues such as payments and intellectual property.

Agencies are becoming more sophisticated and ambitious in their prizes. For example, the Health and Human Services started out with low-level competitions for apps and data gathering and offered either a very small prize purse or no financial incentive at all. Last year, they had four very wide-reaching competitions, including one for \$20 million to develop a rapid, point-of-care diagnostic test for health care providers to use to identify highly resistant bacterial infections.

***What do you see happening in the next 5 years?***

Open innovation efforts are increasingly tied to national priorities and agency goals. Agencies such as the National Aeronautics and Space Administration, U.S. Environmental Protection Agency, U.S. Department of Defense, and U.S. Department of Energy are getting more ambitious by issuing more competitions, taking on harder problems, and offering bigger purses. Open innovation is a tool that will help the Government in the long run. Open innovation goes beyond a single administration, a single effort, or a single year. With this new paradigm, we can transform the Government to partner with vibrant and exciting communities in universities, private industries, and publics to truly encourage

entrepreneurship and engage citizens in addressing the ambitious and demanding problems that face us all.

***Where can people learn more (e.g., toolkits, resources)?***

We are developing a toolkit for open innovation that will be similar to the one we did for crowdsourcing and citizen science, so stay tuned! A variety of leaders are working on the toolkit, which will make it easy for Federal employees to find the information and insights they need to create great competitions. Meanwhile, go to [www.digitalgov.gov](http://www.digitalgov.gov) and [www.challenge.gov](http://www.challenge.gov) for tips and resources.



Chuck Hennig, Deputy Chief of Research, accepts a Challenge.gov award on behalf of Reclamation for “Newcomer of the Year” from Jennifer Gustetic (see pages 16 and 17 in this newsletter). Photograph by Ellie Van Houtte.



***“Twenty-first century businesses will rely on American science and technology, research and development. . . I want Americans to win the race for the kinds of discoveries that unleash new jobs.”***

—President Obama  
2015 State of the Union Address

Open innovation helps Federal agencies unify public and private constituencies around a clear call to action to:

- Identify ideas
- Stimulate markets
- Raise awareness
- Inspire transformation in communities

Open innovation consists of:

- Citizen science
- Internal ideation
- Prize competitions



# Open Innovation Events: Reclamation's Prize-Winning Performances

## More Information

For more information about these events and other Open Innovation events:

## Building Momentum for Open Innovation:

[www.whitehouse.gov/blog/2015/10/22/building-momentum-open-innovation](http://www.whitehouse.gov/blog/2015/10/22/building-momentum-open-innovation)

## Challenge.gov Celebrates Five Years of Open Innovation (complete list of awards and honorees):

[www.challenge.gov/challenge-gov-celebrates-five-years-of-open-innovation](http://www.challenge.gov/challenge-gov-celebrates-five-years-of-open-innovation)

## Reclamation's Water Prize Competition Center:

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

## The Water Prize Competition Center's Water Pavilion at InnoCentive's Challenge Center:

[www.innocentive.com/ar/challenge/browse?pavilionName=Water&pavilionId=1942&source=pavilion](http://www.innocentive.com/ar/challenge/browse?pavilionName=Water&pavilionId=1942&source=pavilion)

See the "Multimedia Around Reclamation" segment in this issue for videos regarding this 2-day engagement.

## All Hands on Deck: Solving Complex Problems Through Prizes and Challenges

On October 7, 2015, the White House, in conjunction with the Case Foundation, the Joyce Foundation, and Georgetown University, hosted the "All Hands on Deck: Solving Complex Problems Through Prizes and Challenges" event. This event included over 150 Federal agency managers, along with state and local government leaders, representatives from foundations and other non-governmental organizations, and private-sector supporters. This event (part of a 2-day engagement with the event shown below) provided concrete tools for designing more ambitious prizes and effectively using incentive prizes to improve outcomes in addressing complex social, policy, and technological challenges.

During the morning plenary session, the White House Administration announced nine new prize competitions from Federal agencies, including the launch of Reclamation's \$30,000-prize competition seeking better methods to measure the food resources available for threatened and endangered fish: [www.challenge.gov/challenge/quantifying-drift-invertebrates-in-river-and-estuary-systems/](http://www.challenge.gov/challenge/quantifying-drift-invertebrates-in-river-and-estuary-systems/) (see article on page 27 in this newsletter).



*In his remarks at the "All Hands on Deck: Solving Complex Problems Through Prizes and Challenges" event, Tom Kalil, Deputy Director for Technology and Innovation in the White House Office of Science and Technology Policy, encouraged participants to use incentive prizes and other market-shaping techniques to address societal challenges. Photograph by Georgetown University. Source: [www.whitehouse.gov/blog/2015/10/22/building-momentum-open-innovation](http://www.whitehouse.gov/blog/2015/10/22/building-momentum-open-innovation).*

## Five-Year Anniversary of Challenge.gov

On October 8, 2015, to celebrate 5 years of public-sector prize competitions and open innovation on Challenge.gov, the General Services Administration hosted senior leaders and Federal innovators from across the Federal Government, including the White House Office of Science and Technology Policy, National Aeronautics and Space Administration, and the U.S. Agency for International Development.

This event (part of a 2-day engagement with the event shown above) highlighted Challenge.gov's progress and impact on government, spotlighted past challenge winners and their success, and honored Federal recipients of the first-ever "Five Years of Excellence in Federal Challenge & Prize Competition Awards."

## Five Years of Excellence in Federal Challenge & Prize Competitions Awards

Reclamation received three awards at the Five-Year Anniversary of Challenge.gov: Newcomer of the Year, Best in Technology, and Unsung Hero.

— continued



— continued

### **Newcomer of the Year (2015) Award**

Reclamation's new Water Prize Competition Center has convened three interagency subject matter expert teams to design high-impact prizes in: water availability, ecosystem restoration, and infrastructure sustainability. This group has also been a leading experimenter within the U.S. Department of the Interior and a thought leader in better connecting the Federal technology transfer community to the Federal prize competition community.

### **Best in Technology Award**

In the Desal Prize of 2015, the U.S. Agency for International Development (USAID) and Reclamation challenged innovators around the world to create cost-effective, energy-efficient, and sustainable desalination technologies to provide water for people and crops. The winning team's design shows the potential for photovoltaic-powered electro dialysis to be a scalable, sustainable, and affordable desalination technology for rural areas of developing countries, as well as Native American and rural communities in the Western United States (see article on page 40 in this newsletter).



**Newcomer of the Year (2015) Award**  
(left to right):  
Dave Raff, Levi Brekke,  
Connie Svoboda, Ian Ferguson,  
Chuck Hennig, Bobbi Jo Merten,  
Andrew Tiffenbach, and  
Jessica Torrey (Reclamation).

**Not pictured:**  
Pat Connolly (USGS),  
Erin Foraker, Matthew Klein,  
and Sean Kimbrel (Reclamation).



**Best in Technology Award**  
(left to right): Levi Brekke,  
Scott Irvine, Frank Leitz,  
John Walp, Saied Deleghah,  
Andrew Tiffenbach,  
Yuliana Porras-Mendoza,  
Steve Dundorf,  
Matthew Hirschbeck,  
Katie Guerra, and  
Kevin Price (Reclamation).  
**Not pictured:**  
Michelle Chapman  
and Randy Shaw  
(Reclamation).

### **Unsung Hero Award**

Challenge.gov also recognized Saied Delagah in Reclamation's Technical Service Center as an "Unsung Hero"—A person who worked hard behind the scenes to make sure things got done in their agency to make the Desal Prize a success. Reclamation contributed over \$500,000 in total labor, equipment, and facility modification costs to the overall success of the Desal Prize.

Reclamation formed a team that diligently worked behind the scenes to ensure the technical integrity of the challenge design and judging process and to quickly prepare Reclamation's Brackish Groundwater National Desalination Research Facility (BGNDRF) in Alamogordo, New Mexico, to host the demonstration stage of the competition. Saied worked closely with USAID to coordinate across multiple agencies and disciplines to lead the challenge design effort. Others were also instrumental: Yuliana Porras-Mendoza, Reclamation's Advanced Water Treatment Research Coordinator, assisted Saied to form and task a cadre of Reclamation technical experts to provide on-the-ground support throughout the competition. Randy Shaw, the Facility Manager for BGNDRF, led the effort to modify and prepare the facility to host the competition. Saied, Yuliana, Randy, and supporting team members worked long, hard hours over many weekends and evenings to fulfill Reclamation's role in the Desal Prize.



**Unsung Hero Award: Saied Delagah**  
(Reclamation) and Tammi Marcoullier  
(Challenge.gov).



# Reclamation's Strategy: Developing Capabilities & Implementing Prize Competitions

—continued from page 3

**Research and Development Office  
Deputy Chief of Research,  
Chuck Hennig**

In 2000, Chuck became the Deputy Chief of Reclamation's Research and Development (R&D) Office. In this role, Chuck co-led the transformation of Reclamation's Science and Technology Program into a Reclamation-wide, competitive intramural R&D program. The transformed program implemented a renewed effort to engage Reclamation's resource managers and stakeholders to better facilitate the development and use of new and improved solutions for water and power supplies for the West.

Chuck also led the implementation of other program initiatives. This included Technology Transfer legislative authorities to form joint-venture research partnerships with the private sector, programmatic climate change R&D initiatives focused on water management adaptation tools and strategies and, now, the Water Prize Competition Center, which implements the prize competition authorities included in the America COMPETES Reauthorization Act of 2010.

In implementing all program initiatives, Chuck emphasizes the power of partnerships to develop solutions quicker, better, and at a lower overall cost than any single partner or entity can do by themselves. Chuck believes the key to successful partnerships are forming teams that not only bring the intersecting technical disciplines to the table, but are also openminded individuals that cultivate a culture of value, trust, and respect for each other while sharing a common passion for finding better solutions.

To establish prize competition business practices and start launching competitions, Reclamation's Water Prize Competition Center in the Research and Development Office received an initial appropriation of \$2 million in fiscal year 2014. The Water Prize Competition Center decided to take a measured, strategic approach to implementation:

**Provide Opportunities Across Reclamation.** Workshops, training, and other outreach efforts help Reclamation staff gain experience and build core capabilities across a broad cross section of Reclamation programs and subject matter experts. Since prize competition authorities can be used by all Reclamation programs and appropriations, spreading the word and building capabilities across Reclamation helps Reclamation use prize competition authorities as effectively and innovatively as possible.



**Build Collaborations.** Working with Federal agencies that have a stake in the problems Reclamation wants to solve enables agencies to leverage Federal capabilities, catalyze interagency working relationships, better define and solve common problems, and avoid duplication. Additionally, the solutions Reclamation receives will have a broader impact across the missions of multiple Federal agencies, for all stakeholders, and for the overall public good.



Reclamation has good collaborative working relationships with Federal agencies that have a stake or similar interest in water and research mission interests. Involving collaborating Federal agencies in prize competitions from the beginning will catalyze efficient collaborations with this new business model going forward. Those that play and learn together tend to stay together and do bigger and better things together.

**Learn.** Prize competition authorities introduced a business model and opportunities unlike anything Federal agencies have ever done. Reclamation and the U.S. Department of the Interior (Department) had no prior experience or established business practices, guidance, and policies. To help accelerate this learning curve, Reclamation relied heavily on the advice from the few agencies that were already running prize competitions. The knowledge, helping hand, and experience of the staff at the General Services Administration's Challenge.gov office, and the support and expertise provided through the White House Office of Science and Technology Policy's Open Innovation Office were invaluable.



By working with the Department's Office of the Solicitor (Solicitor's Office) to study and dissect the prize competition authorities, Reclamation established practices that would comply with and fully use this new legal authority. The Department's Office of the Assistant Secretary for Policy, Management and Budget leveraged the work Reclamation did with the Solicitor's Office and enlisted Reclamation's assistance to develop and publish Department "Guidance for Offering and Administering Prize Challenges for Innovation" in April 2015 ([www.doi.gov/sites/doi.gov/files/migrated/techtransfer/upload/Signed-Memo-Prize-Challenges-for-Innovation.pdf](http://www.doi.gov/sites/doi.gov/files/migrated/techtransfer/upload/Signed-Memo-Prize-Challenges-for-Innovation.pdf)).

**Get Experienced Help.** Enlisting experienced help for initial prize competitions eased the learning curve and provided helpful insights. InnoCentive, hired

— continued

— continued

through a competitive acquisition process, provided prize competition design and administrative services. InnoCentive is one of many qualified companies that provide prize competition design and administrative services. InnoCentive also has a diverse community of about 400,000 registered solvers around the world that Reclamation is able to reach through the InnoCentive Challenge Center online crowdsourcing platform. Interested solvers can register for free at [InnoCentive.com](http://InnoCentive.com).

Reclamation's contract with InnoCentive included prize competition training services to train subject matter experts and program managers from Reclamation and collaborating Federal agencies in the fundamentals of the prize competition business model and the prize design and administration basics.



**Walk.** The first couple of years running prize competitions is a pilot period to build hands-on experience, using several prize competitions to address a spectrum of specific issues. This will allow subject matter experts and program managers across Reclamation to become familiar with the prize competition business model. The short-term prize competitions launched through InnoCentive help garner diverse experience across a wide range of problems, involving a broad spectrum of subject matter experts and programs. The prize purse for smaller scale problems may range from non-monetary to \$100,000 and range from 3 to 6 months to design, launch, and award.

**Run.** At the grand challenge scale, prize purses for revolutionary changes are typically millions of dollars and timeframes can span years. For example, the Ansari XPrize Challenge (<http://ansari.xprize.org/>) was a \$10 million prize competition that ushered in the private space flight industry.

Toward the end of the pilot period, Reclamation's Water Prize Competition Center and partners plan to scope and propose one "grand challenge" prize competition in each theme area—realizing this grand vision will depend on the insights gained through the pilot period, agency support, available budget, and willing partners to help fund and conduct the prize competition.

**Keep Going!** The pilot period will be followed by developing interim "prize competition" guidance and draft policies for Reclamation-wide use. If Reclamation chooses to use prize competitions as an ongoing tool to help bring solutions to bear on Western water problems, the experiences, skills, and guidance gained from pilot period activities will position Reclamation to run with prize competition authorities as a standard operational tool. Forging partnerships will be key to long-term success with prize competitions (see article on page 20 in this newsletter).



Prize competitions are scalable from small and simple to grand challenges:

- Short duration competitions that attempt to solve a key piece of a specific problem, or a problem that is more narrowly defined.
- Calls for ideas to solve a broader problem or pieces of a problem without asking for a solution that is demonstrated to work—like a literature search that also explores creative ideas in people's minds.
- Grand challenges start with ideas and end with a field demonstration. They typically tackle multiple tentacles of a problem. Competitions often consist of several rounds of competition with monetary awards at the end of each round—the progress to the next round of competition.

### More Information

Helpful prize competition related guidance documents:

Guidance on the Use of Challenges and Prizes to Promote Open Government:

[www.whitehouse.gov/sites/default/files/omb/assets/memoranda\\_2010/m10-11.pdf](http://www.whitehouse.gov/sites/default/files/omb/assets/memoranda_2010/m10-11.pdf)

Prize Authority in the America COMPETES Reauthorization Act:

[https://cio.gov/wp-content/uploads/downloads/2012/09/Prize\\_Authority\\_in\\_the\\_America\\_COMPETES\\_Reauthorization\\_Act.pdf](https://cio.gov/wp-content/uploads/downloads/2012/09/Prize_Authority_in_the_America_COMPETES_Reauthorization_Act.pdf)



# Forging Partnerships

## Partnerships

- Better serve the stakeholders and the public
- Better define and solve joint Federal problems
- Leverage capabilities
- Ensure that solutions do not already exist
- Catalyze interagency working relationships
- Ensure solutions will have broader impact
- Meet consultation requirements under prize competition law

A network of willing partners will provide keys to success and sustainable capabilities for Reclamation to run with prize competitions, especially grand challenge scale prize competitions. Prize competition authorities (15 USC 3719) and technology transfer authorities (15 USC 3710a) allow Reclamation to form Federal/non-Federal partnerships to help design, fund, administer, and judge prize competitions. In addition, these authorities allow Reclamation to partner with industry that can contribute the added ability to scale up and commercialize good ideas into products that are ready to better serve the water resources community of practice.

Developing partnership processes and opportunities with non-Federal organizations, including the private sector, is a goal for Reclamation's Water Prize Competition Center during fiscal year 2016. Prior to 2016, the Water Prize Competition Center partnership strategy was to first gain experience and familiarity with the prize competition business model within Reclamation, and forge prize competition capabilities and partnerships with collaborating Federal agencies. With Federal capabilities and coordination in place, the Water Prize Competition Center is in a much better position to offer potential non-Federal partners opportunities to:

1. Team up with subject matter experts, capabilities, and facilities from across the Federal Government
2. Work with Federal staff experienced with the prize competition business model
3. Be part of exciting prize competitions that can bring game-changing solutions to Reclamation and partners with a stake in water and water-related resources
4. Gain worldwide recognition and create worldwide awareness to the problems Reclamation and partners face



*Chuck Hennig, Deputy Chief of Research, co-presenting the "Collaborative Relationships and Roles" workshop session at Reclamation's first prize competition training, Ecosystem Restoration (see next page).*

Reaching out to resources managers and subject matter experts across Reclamation and with their counterparts in other Federal agencies revealed that little was known about prize competitions. Thus, developing an interest and willingness to engage was more difficult than forging collaborations around traditional tools. Training and workshops helped people understand how this may benefit their agencies and forge visions of addressing challenges and working effectively together.

# Water Prize Competition Center Training

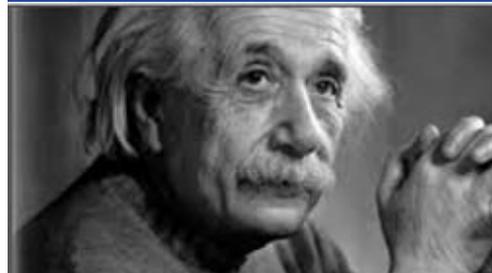
In conjunction with InnoCentive, Reclamation's contractor for prize competition services, Reclamation's Research and Development Office provided prize competition training for Reclamation participants and Federal partners. Each training session included about 50 participants and included representatives from Reclamation's Denver Office and its regional and area offices.

Training courses/workshop sessions were held at Reclamation's Denver Office and helped participants to:

1. Understand the prize competition business model and learn the fundamentals of designing and conducting prize competitions.
2. Build working relationships across Reclamation and with collaborating Federal agencies that enable efficient and effective Federal teams to join forces and collaboratively work on specific prize competitions going forward.
3. Develop an initial list of prize competition topic ideas/problem areas that are a priority for Reclamation and collaborating Federal agencies to find better solutions.

The training included workshop sessions where participants brainstormed and prioritized problems to solve through prize competitions. Participants also practiced deconstructing a problem and designing the framework of the prize competition. Three 2-day workshops were held for each of the three prize competition theme areas:

- **Infrastructure Sustainability, October 2015**, with collaborating participants from the U.S. Army Corps of Engineers (USACE), National Institute of Standards and Technology (NIST), Department of Transportation, Bonneville Power Administration, U.S. Department of Energy, and the State of Colorado.
- **Water Availability, May 2015**, with collaborating participants from the U.S. Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Agriculture's Natural Resources Conservation Service and Agricultural Research Service, U.S. Environmental Protection Agency, USACE, and NIST.
- **Ecosystem Restoration, October 2014**, with collaborating participants from the U.S. Fish and Wildlife Service, USGS, NOAA's National Marine Fisheries Service, and USACE.



*"If I had an hour to solve a problem and my life depended on the solution, I would spend the first fifty-five minutes determining the proper question to ask; for once I know the proper question, I could solve the problem in less than five minutes."*

—Albert Einstein

## More Information

To kickoff Reclamation's Water Prize Competition Center, Reclamation and collaborating Federal agencies participated in a prize competition training and kickoff meeting for the Ecosystem Restoration theme area in October 2014.

See the "Technology Challenges" segment in the Spring 2015 issue of *The Knowledge Stream* at:

[www.usbr.gov/research/docs/ks/ks-2015-02.pdf](http://www.usbr.gov/research/docs/ks/ks-2015-02.pdf)

## Research Office Contact

Chuck Hennig  
Deputy Chief of Research  
303-445-2134  
[chennig@usbr.gov](mailto:chennig@usbr.gov)



US Army Corps  
of Engineers®



U.S. Department of the Interior  
Bureau of Reclamation

# Water Prize Competition Center Theme Areas and Prize Competitions

## Water Availability Theme Area Contacts

Ian Ferguson  
Prize Competition Portfolio  
Manager for Water Operations,  
Monitoring, and Forecasting  
Reclamation's Technical  
Service Center  
303-445-2513  
iferguson@usbr.gov

Andrew Tiffenbach  
Prize Competition Portfolio  
Manager for Water Treatment  
and Water Conservation  
Reclamation's Technical  
Service Center  
303-445-2393  
atiffenbach@usbr.gov

## Partners

- U.S. Geological Survey
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture
- U.S. Environmental Protection Agency
- National Aeronautics and Space Administration
- National Institute of Standards and Technology
- National Oceanic and Atmospheric Administration

## Submit Water Availability Topic Ideas at:

<https://docs.google.com/a/usbr.gov/forms/d/12LiL87yiKmAqgh5uh3zJoDqDiKlh8XNUpohT5wqnUDQ/viewform>

## Water Availability

Water availability is critical to meeting the needs of a growing population and economy. Water resource managers face significant challenges in meeting current and future water demands for agriculture, municipal, industrial, Native American, rural, recreation, power generation, and ecosystem needs. Interest areas include ways to:

- Monitor and forecast water supplies and demands
- Optimally manage and operate water storage and delivery systems
- Conserve existing water supplies
- Develop new sources of water supply through desalination, water recycling, and creative application of traditional and non-traditional water treatment methods
- Conjunctively manage groundwater and surface water resources
- Use social and institutional methods to cultivate long-term solutions



For fiscal year (FY) 2016, this theme area is currently working to form teams and design three prize competitions to:

1. Improve the skill of making sub-seasonal climate forecasts to support springtime water and agricultural management decisions. This prize competition hopes to overcome limited available science and the lack of forecast products of weekly-to-monthly resolution during March through June on leads of 2 weeks to 2 months.
2. Find better ways to incorporate soil moisture data into statistical water supply forecasts. This prize competition plans to seek new ways to use soil moisture information to improve the leadtime and/or accuracy of water supply forecasts.
3. Seek new ideas or technologies that can reduce the burden of managing or disposing of concentrated waste streams produced by desalination processes. Reverse osmosis or other advanced water treatment technologies remove contaminants and produce a waste stream that is commonly known as “concentrate” in the industry. Methods to use or dispose of the concentrate is often a primary obstacle to implementing desalination processes, especially for inland applications where ocean dilution is not an option.

The Water Availability theme area is currently discussing a number of additional topic ideas that could be launched in FY 2016 or FY 2017 that target:

- Water supply and demands forecasts
- Data collection, integration, analysis, and management
- Water treatment and conservation

## Ecosystem Restoration

Protecting and restoring aquatic and riparian environments is vital to ensuring that Reclamation watersheds are healthy and able to continue providing the water supplies that can meet the multitude of competing uses of water in the arid Western United States. Interest areas include ways to:

- Track and monitor fish populations
- Facilitate fish passage at dams, migration through reservoirs, and screening at withdrawal structures
- Manage stream hydrology below dams for fish and wildlife
- Improve habitat conditions for targeted species
- Manage reservoir sediment conditions
- Manage instream channel hydraulic and sediment conditions
- Manage river and reservoir temperatures
- Increase desirable riparian vegetation
- Reduce the spread of invasive species that can impact water deliveries
- Protect threatened and endangered fish



Reclamation's Water Prize Competition Center has begun to launch prize competitions to help address a wide range of challenges in ecosystem restoration. Reclamation's first prize competition on "New Concepts for Remote Fish Detection" was open from July 27, 2015, through August 26, 2015 (see article on page 25 in this newsletter).

Reclamation's second prize competition on "Quantifying Drift Invertebrates in River and Estuary Systems" launched October 7, 2015, through November 16, 2015. Reclamation collaborated with other Federal agencies to find a way to economically detect, count, and identify zooplankton and drift invertebrates. Determining how much food is available for critical fish species is important for habitat restoration and fish recovery efforts (see article on page 27 in this newsletter).

Reclamation's third prize competition on "Downstream Fish Passage at Tall Dams" is expected to launch in March 2016. Effective downstream passage of juvenile fish over or around tall (high-head) dams has proven difficult for large, complex reservoirs with seasonal water surface fluctuations and temperature stratification. Reclamation is seeking new ideas for gaining successful and cost-effective downstream fish passage, while minimizing stress and physical damage to fish and providing high fish collection efficiencies.

Reclamation plans to launch reservoir sediment management and additional fish recovery prize competitions during 2016. Additional ecosystem restoration prize competitions in the area of reservoir sedimentation, reservoir and river temperature management, and invasive species are also being considered.

## Ecosystem Restoration Theme Area Contacts

Connie Svoboda  
Prize Competition  
Portfolio Manager  
Reclamation's Technical  
Service Center  
303-445-2152  
csvoboda@usbr.gov

## Team Members

Pat Connolly  
Fish Recovery Prize  
Competition Coordinator  
U.S. Geological Survey's Western  
Fisheries Research Center  
509-538-2299x269  
pconnolly@usgs.gov

Sean Kimbrel  
Sedimentation Prize  
Competition Coordinator  
Reclamation's Technical  
Service Center  
303-445-2539  
skimbrel@usbr.gov

## Partners

- U.S. Geological Survey
- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers
- National Oceanic and Atmospheric Administration

## Submit Ecosystem Restoration Topic Ideas at:

<https://docs.google.com/a/usbr.gov/forms/d/1C-QNqQXEKz-r2sHeZ8hNRxvRfSE5UzAPaMX0K1deBbI/viewform>



# Water Prize Competition Center Theme Areas and Prize Competitions

## Infrastructure Sustainability Theme Area Contacts

Bobbi Jo Merten  
Prize Competition  
Portfolio Co-Manager  
Reclamation's Technical  
Service Center  
303-445-2380  
bmerten@usbr.gov

Jessica Torrey  
Prize Competition  
Portfolio Co-Manager  
Reclamation's Technical  
Service Center  
303-445-2376  
jtorrey@usbr.gov  
(See "Featured Faces" segment in the Summer 2015 issue).

## Team Members

Matthew Klein  
Condition Assessment Prize  
Competition Coordinator  
Reclamation's Technical  
Service Center  
303-445-2368  
mjklein@usbr.gov

Erin Foraker  
Hydropower Generation Prize  
Competition Coordinator  
Research and Development Office  
303-445-3635  
eforaker@usbr.gov

## Partners

- U.S. Army Corps of Engineers
- U.S. Department of Energy
- Department of Transportation
- National Institute of Standards and Technology
- Tennessee Valley Authority

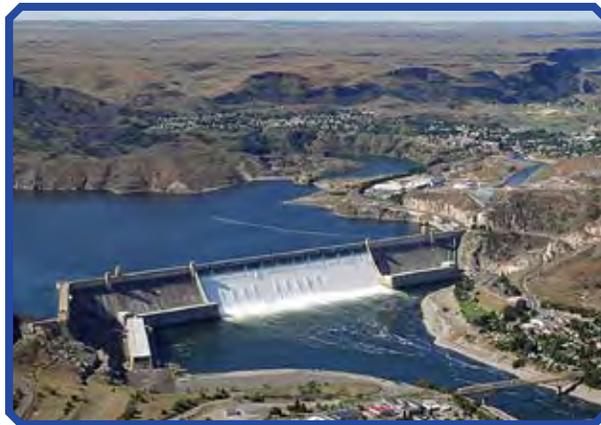
## Submit Infrastructure Sustainability Topic Idea at:

[https://docs.google.com/a/usbr.gov/forms/d/1SVJ19Sna4dP0PE7xU\\_xncYcZ0cVHzBbjo7bsruZPs2E/viewform](https://docs.google.com/a/usbr.gov/forms/d/1SVJ19Sna4dP0PE7xU_xncYcZ0cVHzBbjo7bsruZPs2E/viewform)

## Infrastructure Sustainability

A safe, well-maintained, and reliable inventory of dams, pipelines, hydropower generation facilities, canals, and levees is key to making water available to meet the needs of the Western United States and our Nation as a whole. Interest areas include ways to:

- Effectively and affordably operate and maintain water and hydropower infrastructure
- Repair and replace aging infrastructure
- Monitor and assess the condition of mechanical and electrical equipment, and structures
- Extend the serviceable lives of existing infrastructure and reservoirs
- Optimize hydropower generation
- Detect and heal internal erosion in embankment dams, and canal and levee embankments
- Prevent and detect corrosion



Reclamation's first Infrastructure Sustainability prize competition will be launched in early 2016. A team of geotechnical engineering subject matter experts at Reclamation and the U.S. Army Corps of Engineers are designing the prize competition, "Methods to Identify the Movement of Soils (Internal Erosion) Within Earthen Dams, Canals, Levees, and Their Foundations." This prize competition seeks methods for detecting the movement of particles in earthen structures as internal erosion initiates, or in the early stages of propagation. The goal is to detect the movement of soils earlier than observable by inspection or by currently used instrumentation.

A team of corrosion management subject matter experts are designing a prize competition, for the "Long-Term Corrosion Protection of Existing Steel Structures." In a 1998 study, the National Association of Corrosion Engineers found the annual direct cost of corrosion to be \$276 billion in the United States (U.S.), or 3.1 percent of the U.S. gross domestic product. This prize competition seeks new or improved methods of corrosion control. The goal is to protect steel structures in a manner that provides 50 or more years without significant maintenance or replacement of the protection method.

A high priority topic idea that was identified at the October 2015 Infrastructure Prize Competition Training/Workshop, and will likely launch in 2016, will seek better methods of preventing rodents from burrowing into canal, levee, and dam embankments. Rodent burrows can weaken the structural integrity of these structures. Reclamation plans to launch four to six additional prize competitions on infrastructure sustainability during 2016, including prize competitions that target hydropower generation facilities. Discussions are planned during January 2016, to further discuss and select the topic ideas of most interest to Reclamation and collaborating Federal agencies.



# Reclamation's First Prize Competition: New Concepts for Remote Fish Detection

The ability to track individual or groups of fish is key to efforts to recover threatened and endangered fish species, and to reduce impacts to at-risk species. Reliable, affordable detection and tracking provides vital information about how many fish are present, where and why mortality occurs, and where and why species thrive. This enables fish recovery program managers to pursue targeted and more effective actions that can reduce mortality rates, improve habitat, and increase survival rates while continuing to meet the mission of the agency—delivery of water and power in the case of Reclamation.

When Reclamation and collaborating Federal agencies (U.S. Geological Survey [USGS], U.S. Fish and Wildlife Service [USFWS], U.S. Army Corps of Engineers [USACE], and National Oceanic and Atmospheric Administration's National Marine Fisheries Service [NOAA-NMFS]) were asked to identify challenges in the area of fish recovery, challenges related specifically to fish tracking were identified, underscoring the need for advances in this field. Current tools to track fish have limitations—active fish tags require batteries and are expensive while passive fish tags have a very short detection range. New tools are needed to reduce costs, improve tracking accuracy, improve ease of use, and be longer-lived.

Remote fish detection was selected as the first fish tracking challenge in order to see if the public could assist in identifying the next generation of fish tracking methods, beyond what is currently available and in literature today. Before the prize competition was launched, a multiagency team of experts in the area of fish tracking worked together to clearly define the problem statement. Solvers were asked to submit detailed conceptual proposals that met technical requirements identified in the challenge statement. Reclamation guaranteed to pay the total prize purse of \$20,000 to the top ranked ideas in exchange for all solvers agreeing to grant the Federal Government a no-cost, perpetual license to use all of the ideas submitted. The Federal Government received a license to use all 22 solutions submitted, although prize payments were made to only the top 4 eligible participants.

A team comprised of eight experts in the area of fish tracking from Reclamation, USGS, USACE, and NOAA-NMFS judged the entries. Members of the prize competition design team, along with other experts in the field, were included on the judging panel. The judging panel assessed the submitted proposals by evaluating the ability of each proposal to meet the technical requirements in the challenge and by determining the adaptability, scalability, readiness for development, and originality.

The prize competition was launched July 27, 2015, and the winners were selected in November 2015.

Six solutions were selected for awards, although two of those submissions were later determined to be submitted from non-United States citizens, making them ineligible to win a prize under the America COMPETES Reauthorization Act of 2010 (15 USC 3719). Although the foreign solvers were not eligible to win a prize, they still granted the United States Government a right to use their solution to help in the recovery of threatened and endangered fish.

These top six submissions included ideas that the judges believed had strong promise and should be further tested and demonstrated, all focusing on improving current fish tracking methods. A common theme for five of the six top-ranked submissions was to use fish's swimming motions to self-power a tracking tag (piezoelectric energy harvesting). Other submissions included innovative or novel new approaches, but were considered too difficult or unlikely to transform into practice at this time.

— continued



*Rainbow trout.*

The goal of Reclamation's first prize competition was to generate new concepts for tracking individual fish that meet fish recovery program management needs at a reasonable cost. A successful solution could significantly reduce costs and dramatically increase the effectiveness and efficiency of various fish recovery efforts led by Federal, state, local, and/or other organizations.

## Contacts

**Mark McKinstry**  
Prize Competition Team Co-Lead  
Reclamation's Upper  
Colorado Region  
801-467-2048  
mmckinstry@usbr.gov

**Pat Connolly**  
Prize Competition Team Co-Lead  
U.S. Geological Survey's Western  
Fisheries Research Center  
509-538-2299x269  
pconnolly@usgs.gov

## Partners

- U.S. Geological Survey
- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers
- NOAA's National Marine Fisheries Service



# Reclamation's First Prize Competition: New Concepts for Remote Fish Detection

*“We received a lot of good ideas through this prize competition. We need to develop a plan going forward that considers the best ways to integrate several of these ideas. Although we need to further evaluate the feasibility of these ideas, including their potential adverse impacts on fish physiology, we think it is possible that we can emerge with more effective fish tracking tools at a lower cost than we currently have available.”*

*“The solvers that we spoke to said they were eager to assist the Government in solving challenging problems. While the winners enjoyed receiving the monetary prizes, most of the solvers viewed it as an opportunity to bring their creative juices to bear in solving problems that have vexed others for years, and all winners expressed a willingness to improve society and learn about challenges that people face in other fields of science.”*

Mark McKinstry  
Prize Competition Team Co-Lead,  
Reclamation's UC Region

*“Before the challenge I did not know that much about the current state of fish tagging. It turned out to be a fascinating topic, with some surprising parallels to the technology of mobile phones. It also gave me an excuse to spend a day at the New England Aquarium, observing fish behaviors and how they swim.”*

Rick Rogers  
Honorable Mention Solver

— continued

- The first place winners were Ben Boudaoud and Alicia Klinefelter, Beaverton, Oregon, for their comprehensive proposal on how to make, install, and monitor a piezoelectric tracking tag. Their proposal addressed all the technical requirements stated in the prize competition. Ben has a bachelor's degree in mathematics as well as a bachelor's and a master's degree in electrical engineering and Alicia has a Ph.D. in electrical engineering, both from the University of Virginia, where they met. Ben has primarily worked with medical electronic devices and Alicia works in integrated circuit design. They recently moved to the Pacific Northwest. Ben is an avid fly fisherman, and they have thoroughly enjoyed learning about the region and its fisheries, along with their management.
- The solution submitted by Suman Ummanolla from Hyderabad, India, ranked second and showed Reclamation how to make a fiber optic laser sensor to detect fish tag transmissions underwater.
- The third place winner, Douglas M. Stall, Harrah, Oklahoma, suggested using an energy generator consisting of a tube encasing a small magnet within a copper coil. Douglas has a bachelor's degree in geophysical engineering from the Colorado School of Mines, and has worked as a geophysicist for 22 years.
- An honorable mention went to Rick Rogers, Harvard, Massachusetts, for his idea to use piezoelectric film technology to energize and charge a rechargeable radio-frequency identification (RFID) tag. Rick is a retired software engineer and product manager who has worked for some of the largest companies in high tech (Johnson Controls, Digital Equipment, Intel, Marvell, Motorola, Nokia, Microsoft). Rick has a bachelor's degree in physics from Texas Tech University and a master's degree in electrical and biomedical engineering from Southern Methodist University (Dallas, Texas). Rick's current interests include the Internet of Things network, machine learning, and data visualization using virtual reality. He has written two books on mobile phone software development, and is writing a third. Rick's passions include sailing and traveling—he grew up in the Far East, where his father was stationed in the U.S. State Department.
- An honorable mention went to Ramiz Qandah, Amman, Jordan, for his idea to use piezoelectric film technology to energize and charge a tag.
- An honorable mention went to Dmitriy Tipikin, Medford, Massachusetts, for his idea to use sand particles to vibrate and energize an encapsulated piezoelectric film. Dmitriy has a master's degree in physics and mathematics and a Ph.D. in chemical physics from the Moscow Institute of Physics and Technology (Dolgoprudny, Russia). He worked as an experimentalist physicist in electron paramagnetic resonance, where he received experience as a radio-engineer. He worked in the Department of Chemistry and Chemical Biology at Cornell University (Ithaca, New York) from 2006 to 2011, and later at the Geisel School of Medicine at Dartmouth College (Hanover, New Hampshire) from 2011 to 2015. He is currently unemployed.

The solvers retain intellectual property rights, if applicable, for the idea or concept demonstrated by their solution. Non-United States Government parties interested in using these solutions should seek licenses or permissions from the solvers.

## More Information

[www.innocentive.com/ar/challenge/browse?pavilionName=Water&pavilionId=1942&source=pavilion](http://www.innocentive.com/ar/challenge/browse?pavilionName=Water&pavilionId=1942&source=pavilion). See the “Multimedia Around Reclamation” segment in this issue for a video regarding this prize competition.



# Reclamation's Second Prize Competition: Quantifying Drift Invertebrates in River & Estuary Systems



Close-up of a Stonefly aquatic invertebrate.

Drift invertebrates are insects that drift through rivers and estuaries that serve as a vital food source for threatened, endangered, and other critical fish species. Habitat restoration, improvement, and creation in rivers, streams, and estuaries are key elements for the recovery of salmon, trout, and other critical fish species in the United States. Millions of dollars are spent annually on activities such as manipulating flow regimes, adding structural elements such as wood or rock, reconnecting rivers with their floodplains, and restoring wetlands. A critical aspect in evaluating

the effectiveness of these habitat manipulations is understanding how they influence the food resources available to critical fish species targeted for recovery and protection. Yet despite its importance, quantification of food resources has proven difficult.

Reclamation, in collaboration with other Federal agencies (U.S. Geological Survey, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service) launched a prize competition to find better tools to measure the food sources available for threatened and endangered species. A winning solution will empower fish recovery managers to optimize different habitat manipulations to produce the zooplankton and drift invertebrates that feed fish species targeted for recovery and protection. Protecting and restoring river systems is vital to ensuring that watersheds are healthy and able to continue providing the water supplies that our Nation needs, now and into the future.

This competition launched October 7, 2015, and closed November 16, 2015, and is offering a total prize purse of \$30,000 to pay the top three submissions that meet or exceed the technical criteria—a prize award of \$10,000 each. If only a single submission meets or exceeds the criteria, the prize award may be as high as \$15,000.

This competition is being conducted as a “theoretical” competition with solvers required to submit supporting scientific theory that supports their solution. No prize awards are guaranteed for a theoretical competition unless they meet or exceed the technical criteria. The Federal Government only receives a perpetual license to use the submissions that are awarded a monetary prize payment.

Twenty-four submissions were received when the prize competition closed on November 16, 2015. A multiagency judging panel has been convened to assess the submitted proposals by evaluating the ability of each proposal to meet the technical requirements in the challenge and by determining the practical feasibility, detection precision, manufacturing cost, required power source, extra weight/space, and time to market. Reclamation plans to select the winners in January/February 2016.

## Contacts

Josh Israel, Ph.D.  
Fish Biologist  
Prize Competition Team Co-Lead  
Bureau of Reclamation  
916-414-2417  
jaisrael@usbr.gov

Eric Danner, Ph.D.  
Research Ecologist  
Prize Competition Team Co-Lead  
NOAA's National Marine  
Fisheries Service  
831-420-3917  
eric.danner@noaa.gov

## Partners

- U.S. Geological Survey
- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers
- NOAA's National Marine Fisheries Service

## More Information

[www.innocentive.com/ar/challenge/browse?pavilionName=Water&pavilionId=1942&source=pavilion](http://www.innocentive.com/ar/challenge/browse?pavilionName=Water&pavilionId=1942&source=pavilion)

See the “Multimedia Around Reclamation” segment in this issue for a video regarding this prize competition.



# Challenge.gov: A New Way for Everyone to Win



*Tammi Wark Marcoullier*

Tammi Wark Marcoullier manages the Federal Challenge & Prize Program, an open innovation initiative that includes the Challenge.gov platform and focuses on crowdsourcing solutions to mission-centric problems.

Ms. Marcoullier is a digital strategist specializing in technology adoption, innovation, and citizen engagement programs, including:

- Problem definition
- Program design
- Crowdsourcing
- Ideation
- Platform management
- Change management
- Program analysis and reporting
- Training

On behalf of the Water Prize Competition Center, Reclamation's Technical Service Center interviewed Tammi Wark Marcoullier from Challenge.gov to get some advice for Federal agencies that are contemplating and creating challenges.

## *What makes for a successful challenge?*

A clearly defined problem is the key. Understand why it has not been done yet and what benefit would come from having a solution to that problem. Identifying the things people will care about solving is core to the prize competition development. And the critical measure for success in launching a challenge competition is being able to say, "by solving this problem, we meet our mission of \_\_\_\_."

The public will rally around a mission—they want to know they are making a difference. Look at the 798 entries to stop Robocalls and thousands of people who contribute to the National Aeronautics and Space Administration's competitions—they strike an emotional, intellectual, and creative chord with the public. With the time and effort it will take for you to run your program, you want to have a result that will make a difference, too.

Open brainstorming and collaboration are critical to develop viable incentive competitions. Take the time to define the problems and develop the challenge program with experienced peers and mentors. Take out the word "but" from conversation when you are brainstorming and replace it with "and"—work in the realm of possibility, not what is known or biases. You can see some success stories at: [www.challenge.gov/success-stories](http://www.challenge.gov/success-stories).

## *Why should agencies participate in Challenge.gov?*

Challenge.gov is the hub for all Federal incentive prize competitions and is the data collection platform for metrics and reporting results. Regardless of where agencies are hosting and managing their crowdsourcing effort, agencies put a promotional listing on the site. Behind the public view, the White House Office of Science and Technology Policy, General Services Administration (GSA) (platform administrators), and all agencies will soon be able to access years of data and materials from current and historical competitions.

There is also the platform hosting component of Challenge.gov, where agencies have a full-feature platform available at no cost. There are dedicated agency pages, program pages with discussion boards, rules and terms, solution upload, public voting, and many other tools.

Since launching in September 2010, Challenge.gov has listed over 630 competitions from more than 80 agencies. The site has had 4.5 million visits over these 5 years, with visitors from every country and every large city in every state in the United States, and more than 200,000 solvers contributing ideas, scientific expertise, technology, and creative solutions.

## *How can Federal and non-Federal entities work together to identify, frame, and solve challenges that affect more than one entity?*

A key component for working across agencies and partners is to find a way to frame the challenge so that it fits the larger need. You want to make sure the stakeholders can have a takeaway that they can implement or use the results to further their mission. When people dig so far down in the weeds of minutiae,

— continued

— continued

others may not see a need for that specific issue, and they can be alienated from the process.

Clearly define the roles within the partnerships and be flexible, but accountable. In nearly every competition across government the agencies have been delighted with, and surprised by, the entries where they receive solutions that are beyond what they had hoped for in the beginning.

### ***Who can participate in solving challenges?***

Everyone! A good idea is a good idea regardless of credentials, experience, or connections. This is why we call it “Open Innovation”—challenges are open to anyone who wants to submit. If a barrier to entry is too high or too specific, the people who have, or who can come up with, the best solutions may never try. Agencies do not require solvers to submit qualifications; otherwise, you will end up with the same answers as you have been getting from the same people you have been working with before the competition.

Solvers come from a variety of backgrounds, including experts, hobbyists, or people whose area of expertise in a similar discipline brings a unique view to your deconstructed problem. For example, in fish tracking, a potential solver does not need to be an expert on fish, but may be an expert in tracking devices that can be submerged in water or someone who works with general communication technologies. That said, please consult the legal authority under which you are running your program to comply with residency restrictions, if any. The prize competition authorities included in the America COMPETES Reauthorization Act restricts the eligibility to win a prize to United States citizens, permanent residents, and entities incorporated in and that maintain a place of business in the United States.

### ***How can agencies set up challenges to attract the best problem solvers?***

A good challenge competition is designed to entice people to participate. You offer an incentive or prize that is unique and valuable to the solver audience, which is different from a traditional contracting audience. You will also appeal to their sense of gaming and fun by making it a challenge to compete the task—whether through an accelerated timeline, or asking for what industry experts would say is an “impossible” goal.

### ***How can agencies reach out to potential solvers?***

To get people to participate, invite them.

Really. This is not “Field of Dreams” where if you build it, they will come. You have to go out into the world and tell everyone in your field and related fields what you are doing and invite them to participate. Find professional groups, conferences, social groups, meetups, online groups, etc., and share your competition with them. It is very important to talk with the industry experts, too. They may be working on something behind the scenes that could benefit the project or may decide they want to use your challenge for a research and development initiative.

Go beyond press releases and look for engagement opportunities on social media and other digital communities. And once people express interest, stay in communication with them throughout the challenge. It is what we call “solver engagement.” Because what we have seen over the years is that competitors enter multiple challenges and, even when they lose, they come back and win.

***“The work you’re doing at Reclamation is outstanding. In one case, for example, tracking fish can provide insights into tracking people or other organisms. Among our federal peers and with the public, we benefit from sharing ideas and being open to possibilities.”***

**Tammi Marcoullier  
Federal Challenge & Prize  
Program**

**Challenge.gov is a centerpiece for the President’s Strategy for American Innovation, bringing diverse ideas, technical, scientific, and creative solutions from the public through crowdsourcing initiatives. It is both the complete listing of every publicly open Federal challenge competition and a platform on which agencies can manage their programs.**



### **Challenge.gov Contact Information**

**Email Team: [challenge@gsa.gov](mailto:challenge@gsa.gov)**

### **Social Media:**

**<https://twitter.com/ChallengeGov>**

**[www.facebook.com/ChallengeGov](http://www.facebook.com/ChallengeGov)**



**U.S. Department of the Interior  
Bureau of Reclamation**

# The Desal Prize Followup— Concepts From the Desal Prize Go Global

## Research Office Contact

Yuliana E. Porrás-Mendoza  
Advanced Water Treatment  
Research Coordinator  
303-445-2265  
yporrasmendoza@usbr.gov

In April 2015, Reclamation co-sponsored the U.S. Agency for International Development (USAID) Desal Prize, which challenged innovators around the world to create cost-effective, energy-efficient, and sustainable desalination technologies to provide water for people and crops. Reclamation provided the laboratory testing facilities and engineering and scientific expertise at its Brackish Groundwater National Desalination Research Facility (BGNDRF) in Alamogordo, New Mexico, for the five teams that made the final cut with their renewable energy-powered water desalination technology. The finalists openly shared their ideas, suggested tweaks to their competitors' systems, and held sessions to showcase and discuss their technologies.

The winners have continued the efforts that this challenge spawned to further test their systems in developing countries:

**First Place:** MIT and Jain Irrigation Systems designed a photovoltaic-powered electro dialysis reversal system that desalinates water using electricity to pull charged particles out of the water and further disinfects using ultraviolet rays. The system was designed for low-energy consumption, limiting costs—especially in off-grid areas. Using the funding from this prize, they are moving forward with two pilot plants in Jalgaon, India. These systems are in the final stages of being built and initial testing. Full technical and user testing will occur in January 2016.

**Second Place:** University of Texas at El Paso (UTEP) Center for Inland Desalination System designed a Zero Discharge Desalination (ZDD) technology that reduces water waste in the desalination of groundwater by conventional processes. This combines reverse osmosis with electro dialysis metathesis that can maximize water production, minimize waste volume, and recover useful byproducts, such as gypsum and sodium chloride.

The UTEP team has now partnered with a Honduran university, “Universidad Politécnica de Ingenierías (UPi),” the national water service of Honduras, “Servicio Autonomo Nacional de Acueductos y Alcantarillados (SANAA),” and an American company, “JCI Industries,” to demonstrate ZDD in Honduras. UPi is a relatively new private university that specializes in engineering and environmental sciences, and they will assist with training activities. SANAA has assisted UTEP in locating potential pilot sites and providing preliminary water quality analysis. JCI Industries supplies and services water and wastewater equipment for both the industrial and municipal markets.

— continued



*First Place: MIT and Jain Irrigation Systems.*

## More Information

[www.securingswaterforfood.org/  
the-desal-prize/](http://www.securingswaterforfood.org/the-desal-prize/)

[www.challenge.gov/agency/  
department-of-the-interior/  
bureau-of-reclamation/](http://www.challenge.gov/agency/department-of-the-interior/bureau-of-reclamation/)

[http://engineering.unt.edu/  
unt-led-team-among-top-three-  
international-desal-prize-  
competition](http://engineering.unt.edu/unt-led-team-among-top-three-international-desal-prize-competition)

See the “Multimedia Around Reclamation” segment in this issue for videos regarding the Desal Prize.



*Second Place: UTEP Center for Inland Desalination Systems.*

— continued

Piloting activities are expected to begin in early 2016 in the region of Valle, Honduras (southwest of Tegucigalpa), or another site.

**Honorable Mention:** Green Desal, a team comprised of the Asian Institute of Technology & Management, National Center for Agricultural Research and Extension, State University of Ponta Grossa, Technion-Israel University of Technology, and University of North Texas (UNT), developed a high-percent recovery system that integrates proven technologies in reverse osmosis, ion exchange, and nano-filtration. The system is powered by a hybrid solar-wind system.

Since September 2015, this technology has been installed at BGNDRF for long-term testing. The team plans to transfer the system to a farm in the Alamogordo, New Mexico, community once tests are concluded in a few months. They are developing collaborations with New Mexico State University and UTEP to further the technology and develop joint research opportunities. UNT received a 2-year grant from the Institute of International Education, Global Innovation Initiative, U.S. Department of State, for “implementing and monitoring a sustainable desalination pilot-scale plant” in Parana, Southern Brazil. This project is in conjunction with University College London, State University of Ponta Grossa, Brazil, and SANEPAR (Water and Sanitation Company of Parana State).



Honorable Mention: Green Desal.



During the week of April 7, 2015, five finalist innovator teams competed for \$200,000 in prize funds in head-to-head demonstrations at Reclamation's BGNDRF in Alamogordo, New Mexico.



# Lessons Learned

*“It has been phenomenal to work with a lot of smart, passionate people from different agencies and the non-Federal solver community.”*

Chuck Hennig  
Deputy Chief of Research



**Challenge.gov**

**Big Ideas:  
Imagination  
Powering  
Innovation**

**Problems solved,  
innovations deployed:**

- Robots
- Medical devices
- Business plans
- Mobile Apps
- Sensors
- Algorithms
- Software

@ChallengeGov  
challenge@gsa.gov

See the back cover of this issue for a comparison of “open innovation” and “traditional avenues.”

Lessons learned are intended to be used throughout the prize competition lifecycle to collect information that has been obtained during any phase of what worked well and what did not work well. Documenting lessons learned will provide for ongoing improvement of best practices, and is for sharing and using knowledge derived from experience to help promote the recurrence of desirable outcomes and help deter the recurrence of significant adverse events or trends.

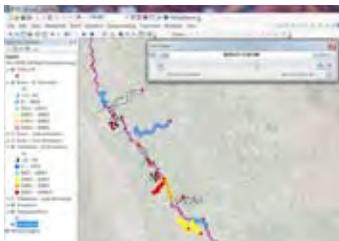
Advice for future prize competitions include:

- **Be open to new approaches.** Let go of the traditional grant and procurement approaches of telling people exactly what you want them to deliver and how to do it. Instead, the point is, tell them the goals you want to achieve and the results you are seeking. Let the solvers be creative in how they get there.
- **Work with people who have conducted prize competitions.** Getting insights on the process and the best way to get results from people with experience in prize competitions is invaluable.
- **Bring in partners.** Do not assume that one agency is the only one grappling with a challenge. Look at other agencies (Federal, state, local, and even non-governmental entities) to determine who else needs the same solution.
- **Identify common problems and solutions.** Drawing “problem circles” to determine where problems overlap and where problems can benefit from common solutions helps define the problems and their boundaries.
- **Create an effective problem statement.** Spend a lot of time on formulating the problem so that solvers can focus on the best solution.
- **Focus on the outcome rather than the methods.** To truly get new ideas, define the problem in terms of what is needed to address the underlying issue. For example, rather than asking how astronauts can use a pen in space, ask how astronauts can take notes.
- **Define your problem to appeal to a wide range of solvers.** In the best competitions, the problem is defined in a way that a wide array of people can see themselves engaging and participating.
- **Do not assume that the solution will come from “the usual suspects.”** There is a bigger pool of people out there that may have ideas that are not even known to exist—from all over the world and from many different fields of expertise.
- **Consider “staging” challenges.** Sometimes it is best to ask for concepts or approaches to solve a problem, and then ask for specific solutions within that concept.
- **Make sure there is enough time to follow up.** Getting the solution is just the first step in a much longer process.

# Research Updates

## Bulletin Title, Quote, and Website

Page



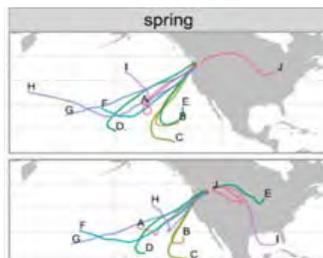
### Visualizing Salinity in the San Joaquin River

*“We continue to experiment with visual aids to track and improve our understanding of salt load assimilative capacity in the San Joaquin River Basin. Stakeholders can use a single dashboard and come away with new knowledge of a system they have known for decades and, perhaps, insights into becoming more effective and responsible resource stewards.”*

Nigel W.T. Quinn, Water Resources Engineer  
Reclamation’s Mid-Pacific Region

[www.usbr.gov/research/docs/updates/2016-01-salinity.pdf](http://www.usbr.gov/research/docs/updates/2016-01-salinity.pdf)

34



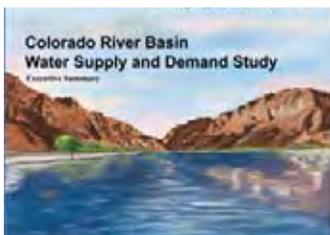
### Forecasting Extreme Flooding Events

*“Understanding the dynamics behind extreme flood events will help Reclamation answer questions such as: Will floods become more severe and threaten flood infrastructure under climate change? Is Reclamation’s infrastructure adequately designed to perform under any increased risk due to climate change?”*

Subhrendu Gangopadhyay, Supervisory Civil Engineer  
Reclamation’s Technical Service Center

[www.usbr.gov/research/docs/updates/2016-02-forecasting.pdf](http://www.usbr.gov/research/docs/updates/2016-02-forecasting.pdf)

36



### Treat Impaired Water or Import Fresh Water?

*“Treating a locally available, impaired water resource offers advantages over importing fresh water for some applications.”*

Katie Guerra, Chemical Engineer  
Reclamation’s Technical Service Center

[www.usbr.gov/research/docs/updates/2016-03-water.pdf](http://www.usbr.gov/research/docs/updates/2016-03-water.pdf)

38



### Solar Photovoltaic Desalination Using Distillation

*“This research project will allow the 150 families in this area of the Navajo Nation much closer access to better quality water. These families now travel to Leupp, or even Flagstaff, Arizona, to obtain their livestock and drinking water. This will reduce their travel time and associated costs. Moreover, this concept can be replicated anywhere in the world where people need better quality water and do not have access to the traditional water and electrical infrastructure.”*

Mitchell Haws, Water Resources Planner  
Reclamation’s Lower Colorado Region

[www.usbr.gov/research/docs/updates/2016-04-photovoltaic.pdf](http://www.usbr.gov/research/docs/updates/2016-04-photovoltaic.pdf)

40



## Research Update

Winter 2015-2016  
Bulletin 2016-01

### Bottom Line

This research project enhances understanding of the changing flows and salinity conditions in the San Joaquin River and how they affect salt loads. Real-time salinity management requires real-time access to this information.

### Better, Faster, Cheaper

Providing salinity information for stakeholders is the first step towards complete San Joaquin Basin water quality management. Improved coordination will promote water storage in New Melones Reservoir and optimize salt export from the San Joaquin River Basin, while meeting water quality objectives at the Vernalis compliance monitoring station.

### Principal Investigators

Jun Wang, Ph.D., P.E.,  
Water Resources Modeler  
Decision Support Branch  
Mid-Pacific Region  
916-978-5189  
junwang@usbr.gov

Nigel W.T. Quinn, Ph.D., P.E.,  
D.WRE  
Water Resources Engineer  
Decision Support Branch  
Mid-Pacific Region  
916-978-5079  
nquinn@usbr.gov

## Visualizing Salinity in the San Joaquin River

Decision support tool summarizing San Joaquin River salinity conditions for the past 30 days

### Problem

Salinity management of the lower San Joaquin River is required to ensure compliance with State water quality objectives set for salinity. Before 2000, salinity objectives at the Vernalis compliance monitoring station on the San Joaquin River were routinely violated. A salinity Total Maximum Daily Load (TMDL) was adopted as the customary approach to water quality regulation.

Reclamation and San Joaquin Basin stakeholders embraced a novel concept of real-time salinity management to achieve the goals of the TMDL while maximizing salt export from the basin. Under real-time salinity management, strict salt load-based limits set monthly for each of seven sub-basins within the San Joaquin River Basin are replaced by a single concentration objective at Vernalis. Monitoring, modeling, and model-based forecasting provide relevant salt load assimilative capacity information to stakeholders to improve cooperation, coordination, and scheduling of San Joaquin River salt loading needed to stay within the 30-day-running average salinity objectives. Real-time management in the Basin Water Quality Plan provides a more equitable and resource-efficient way to use river resources.

### Solution

This Reclamation Science and Technology Program research project was a first attempt at building some of the needed visualization capability to develop real time salinity management. It provides a prototype visualization tool to calculate and display San Joaquin River salt loading to allow assessment of salt load assimilative capacity for real-time management by:

- Using ArcGIS software to develop a line segment map that shows the approximate length of river channel associated with each monitoring station along the San Joaquin River for major east-side and west-side drainages and the major points of diversion.
- Developing a data parser to download the raw data from the California data exchange for each monitored site and then separate time series parameters for flow and electrical conductivity (EC).
- Summarizing these raw data as daily mean values.



New Melones Dam and Reservoir,  
California

This novel approach to real-time salinity management requires that significant changes be made to allow coordination between west-side agricultural and wetland return flows to the San Joaquin River and releases from east-side reservoirs and operational spills of high-quality water that supply mostly east-side irrigation districts. New decision support tools with state-of-the-art visualization capabilities are required to develop this needed collaboration. This new initiative will be called “WARMF-Online” and will provide access to all continuous, telemetered flow and EC monitoring data measured within the basin to calculate salt load (EC times flow). Participants will use the same visualization framework to access model output and model-based forecasts of flow, EC, and salt assimilative capacity.

## Application

Time series data at several monitoring sites had different averaging periods, and the data at these sites had to be processed separately. After interviewing several stakeholder decisionmakers, daily mean flow and EC were determined most critical. Calculating the salt load at all river, drainage, and diversion monitoring stations allowed estimation of salt assimilative capacity at the Vernalis and Maze Road sites. The parsed flow, EC, and salt load data were then associated with each river, drainage channel, and diversion arc using the ArcGIS attribute file for each monitoring station. Using the “MapObjects” toolbox, a map was created with a time series data slide bar to display the last 30 days of flow, EC, and salt load data as colored line segments. In addition, a data table was added below each monitoring station label to show current daily parameter values.

## Results

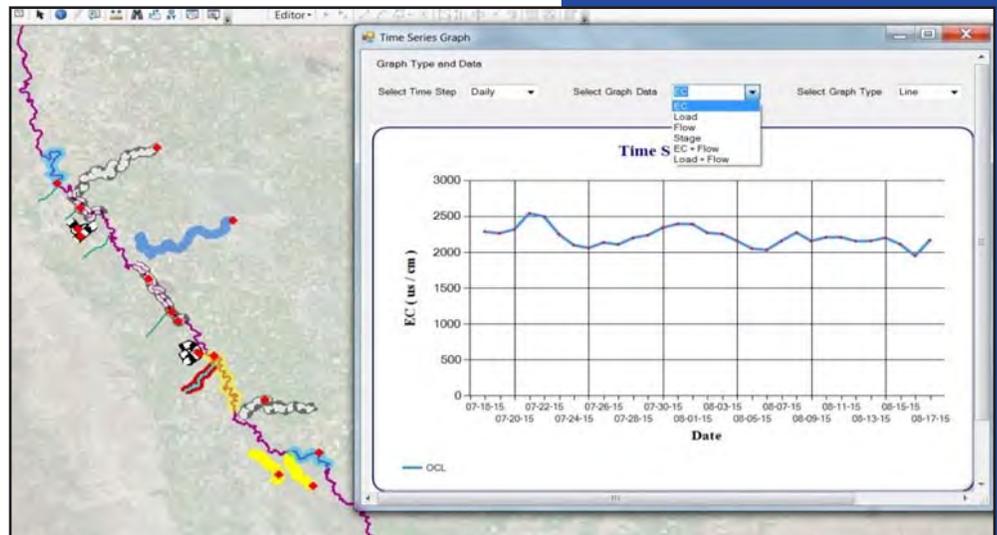
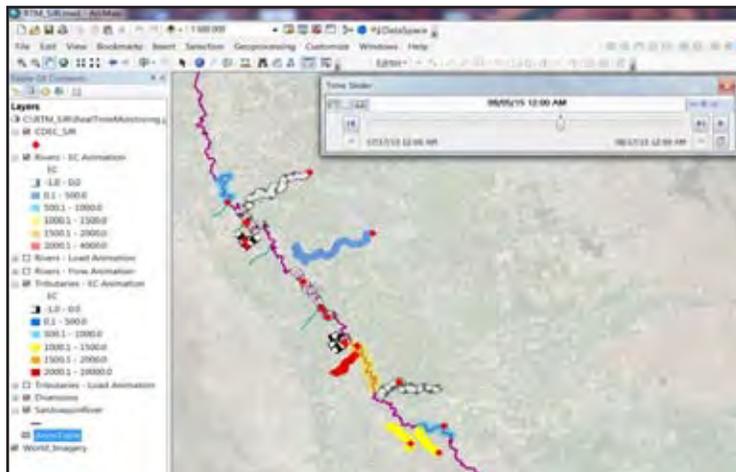
The parser and visualization tool worked very well for sites that currently provide raw data to the WARMF-Online website. (Although all of the eight west-side stations are operational, only two of them provide data that can be visualized using this tool.)

This method allowed a swift, easy to interpret visual depiction of salinity concentration and load trends in the San Joaquin River and its tributaries, which become the basis for flow, EC, salt load, and salt load assimilative capacity forecasting.

## Future Plans

A Reclamation consultant is developing a very similar visualization interface using a public domain, Geographic Information System (GIS)-based tool called “Open-NRM,” which will build upon the current project. This is the first step in building the WARMF-Online web portal as a central hub for salt managers in the San Joaquin Basin. The tool can provide animation of flow, EC, and salt load of San Joaquin River and its tributaries.

Further long-term research and ongoing analysis are needed to guide ongoing development of WARMF-Online and improve monitoring station design placement in the basin to overcome current flow and salinity forecasting impediments. Data and information dashboards are being developed for individual stakeholders, and stakeholder groups, to enable a better understanding of those data necessary for decisionmaking. These dashboards are being shared with all stakeholders on the WARMF-Online web portal. Feedback from these dashboards is helping to guide the next generation of flow and salinity visualization tools.



***“We continue to experiment with visual aids to track and improve our understanding of salt load assimilative capacity in the San Joaquin River Basin. Stakeholders can use a single dashboard and come away with new knowledge of a system they have known for decades and, perhaps, insights into becoming more effective and responsible resource stewards.”***

**Nigel W.T. Quinn**  
Water Resources Engineer  
Reclamation’s Mid-Pacific Region

## Research Office Contact

**John Whitley**  
Science and Technology  
Program Manger  
303-445-2241  
jwhitley@usbr.gov

## More information

[www.usbr.gov/research/projects/detail.cfm?id=3942](http://www.usbr.gov/research/projects/detail.cfm?id=3942)

*Top figure: EC animation of San Joaquin River and its tributaries.*

*Bottom figure: Daily time series EC at OCL.*

## Research Update

Winter 2015-2016  
Bulletin 2016-02

### Bottom Line

This research project investigated the statistically likely moisture sources and pathways for extreme flooding events and how they vary seasonally and spatially.

### Better, Faster, Cheaper

Understanding extreme flooding events is key to designing and planning infrastructure to withstand floods and operate safely. Research results will help inform in modeling, simulating, and predicting extremes in space and time and, consequently, for resource management. This research addresses identified needs in climate research—Long-term user needs document gap 4.03, “Method and basis for estimating extreme hydrologic event possibilities in a changing climate.”

### Principal Investigator

Subhrendu Gangopadhyay  
Supervisory Civil Engineer  
Water Resources Planning and  
Operations Support  
Technical Service Center  
303-445-2465  
sgangopadhyay@usbr.gov

### Principal Researcher

Cameron Bracken  
Civil Engineer  
Water Resources Planning and  
Operations Support  
Technical Service Center  
303-445-2792  
cbracken@usbr.gov

## Forecasting Extreme Flooding Events

*Understanding the causes of extreme floods to predict floods in a season and through many decades*

### Problem

Floods and heavy rainfall pose a terrifying reality for the Western United States. Yet the average timing and magnitude of extreme events vary widely by season and location in the West. How often will extreme events occur? Will a changing climate mean more frequent flooding? If so, where and how? Understanding the atmospheric and hydrologic mechanisms behind extreme events can help Reclamation and others plan by providing decadal estimates of risk and seasonal forecasting. These answers are crucial for Reclamation’s design and planning to ensure its existing infrastructure can meet its future needs, as well as efficient operation and maintenance from season to season.

### Solution

This Reclamation Science and Technology Program research project helped answer the following questions about extreme events in the Western United States:

1. Can Reclamation objectively define regions in which extremes behave similarly, and how many regions are appropriate?
2. What are the dominant moisture sources and pathways for extreme precipitation in each season for these regions?
3. How do seasonal moisture sources and pathways change under El Niño-Southern Oscillation (ENSO) regimes?

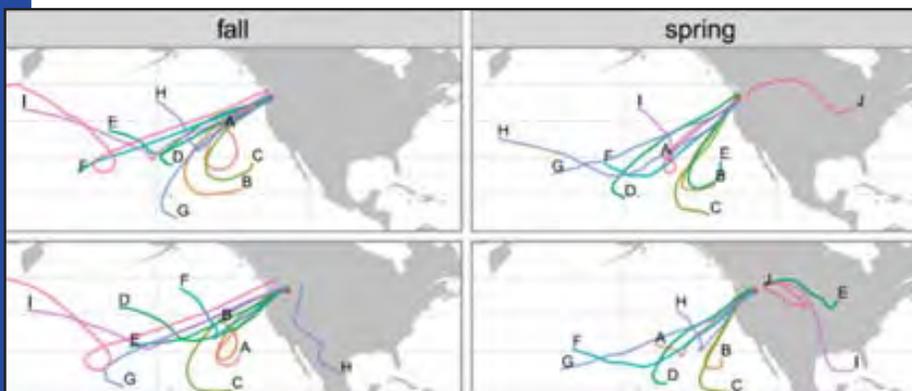
### Applications

To examine how extreme events behave and vary, both by season and location, researchers:

- Obtained daily observed precipitation data
- Computed back trajectories (air pathways that arrive at a location during an extreme event—see figure)



*The San Acacia Diversion Dam peaked the morning of September 16, 2013, at more than 7,000 cubic feet per second. The dam is on the Rio Grande River in San Acacia, 15 miles north of Socorro, New Mexico.*



— continued

*Computed back trajectories.*

- Identified seasonally coherent regions for extreme events using an improved extreme value clustering method
- Determined moisture sources
- Investigated ENSO influence on moisture sources, pathways, and extreme event frequency

## Results

Based on storm back trajectory analysis, researchers were able to demonstrate unique moisture sources and dominant moisture pathways for each spatial region. Findings concluded that:

- ENSO does not strongly affect moisture source locations, but it does affect the frequency of extreme events.
- Winter and summer extremes display distinct patterns of moisture delivery, timing, and magnitude throughout the Western United States. Winter extremes behave mostly uniform across the West, while summer extremes are much more variable, and fall and spring are transitions between these seasons.
- Moisture sources include:
  - ◇ Inland regions in fall, spring, and summer: the Pacific Ocean (including the Gulf of California) and the Gulf of Mexico.
  - ◇ Northeastern regions (mostly Wyoming and Montana): land surface.
  - ◇ Coastal regions (including Northern California, Oregon, and Washington): the Pacific Ocean.
  - ◇ Southwest regions (including Southern California, Arizona, New Mexico, and western Colorado) in the summer: the Gulf of Mexico, Gulf of California, and the Pacific Ocean.

## Future Plans

This analysis opens the door to many new applications, such as short-term projections similar to those made for storm tracks. These back trajectory projections could be coupled with spatial extreme models to produce maps of extreme precipitation and hydrologic extremes for resource management planning.

Future research could:

- Identify higher resolution features (e.g., specific pathways through mountains). Using newer and shorter duration datasets could also provide more detailed examinations of pathways.
- Resample back trajectories to produce physically based simulations of extreme precipitation.
- Investigate the climatic conditions in moisture source regions that favor the production of extremes, potentially to develop statistical forecast models.
- Compare the relative contribution of the land surface and open water bodies as a moisture source for extreme precipitation.

***“Understanding the dynamics behind extreme flood events will help Reclamation answer questions such as: Will floods become more severe and threaten flood infrastructure under climate change? Is Reclamation’s infrastructure adequately designed to perform under any increased risk due to climate change?”***

**Subhrendu Gangopadhyay**  
Supervisory Civil Engineer  
Reclamation’s Technical Service Center

## Research Office Contact

**Levi Brekke**  
Chief of Research  
303-445-2494  
lbrekke@usbr.gov

## Collaborators

University of Colorado, Boulder

## More information

[www.usbr.gov/research/projects/detail.cfm?id=1916](http://www.usbr.gov/research/projects/detail.cfm?id=1916)

**Bracken, C., B. Rajagopalan, M. Alexander, and S. Gangopadhyay. 2015.**  
**“Spatial variability of seasonal extreme precipitation in the Western United States.”**  
**Journal of Geophysical Research: Atmospheres.**  
**10.1002/2015JD023205**

## Research Update

Winter 2015-2016  
Bulletin 2016-03

### Bottom Line

This research project used two case studies to compare the benefits and limitations of treating locally available impaired water versus importing fresh water.

### Better, Faster, Cheaper

When communities are evaluating a new supply of water, choices between local and imported supplies need to be carefully considered. Understanding which factors to consider will pave the way for more cost-effective ways to meet local water demands.

### Reclamation Investigator

Katie Guerra, Ph.D., P.E.  
Chemical Engineer  
Water Treatment  
Technical Service Center  
303-445-2013  
kguerra@usbr.gov

### Research Office Contact

Yuliana Porrás-Mendoza  
Advanced Water Treatment  
Research Coordinator  
303-445-2265  
yporrasmendoza@usbr.gov

### Collaborators

- Reclamation's Technical Service Center
- Oklahoma-Texas Area Office in Reclamation's Great Plains Region

## Treat Impaired Water or Import Fresh Water?

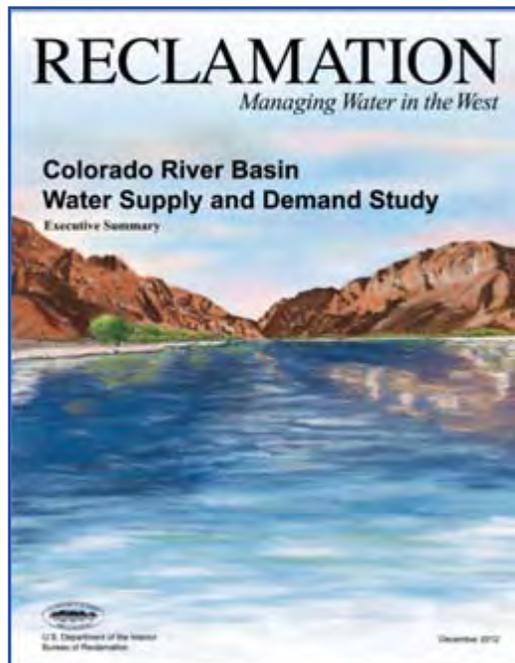
*Evaluating the benefits of treating locally impaired water supply sources versus importing fresh water*

### Problem

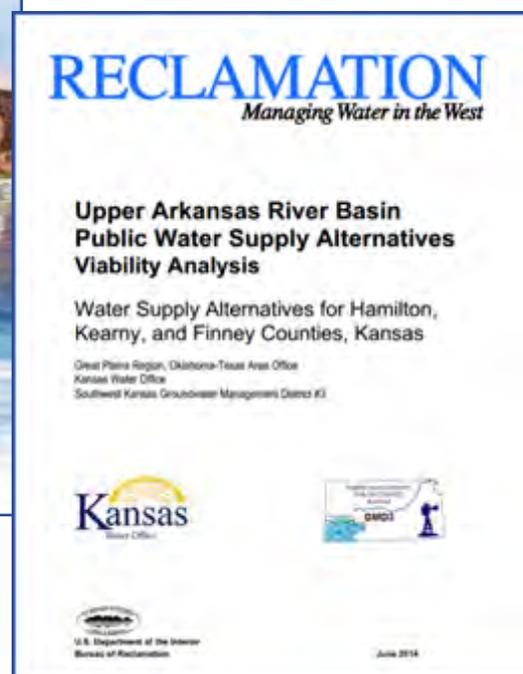
Communities often face a choice between treating local water or importing fresh water. Advanced water treatment technologies are often considered costly; however, high costs and issues also exist when moving water from one location to another. Communities need to evaluate risks and benefits of using advanced water treatment, rather than conventional water supply techniques. For example, a water treatment plant might be able to treat a local brackish groundwater source at a fraction of the cost it would take to construct a lengthy pipeline to deliver fresh water from miles away. At what pipeline length will treatment be cost competitive? Clearly, the answer to this question is site specific and depends on a number of factors. Understanding which factors to consider is crucial to water management decisions.

### Solution

Using the information from two previously conducted Reclamation studies (see figure), this Reclamation Science and Technology Program research project compiled a list of key factors used to determine the feasibility of advanced water treatment compared to other water supply methods.



Previously conducted Reclamation studies.



## Application and Results

In general, the costs for treating local supplies may be lower than the costs for constructing pipelines to import water, but the annual operation and maintenance (O&M) costs may be higher. The primary concern with treating water, compared to importing water, is disposing of treatment residuals and brine. Yet overall, the lifecycle costs are similar, or slightly lower, for water treatment compared to importing water. Some of the key challenges for importing fresh water are permitting requirements, the potential for land disturbances, and the need for easements and access to land. Additionally, importing water is generally considered to be less sustainable.

Key criteria for comparing treatment and importation include:

- **Annual O&M Costs.** In general, annual O&M costs associated with maintaining an advanced water treatment facility are greater than costs for importing higher quality raw water sources. The O&M costs for importation are significantly influenced by pumping distances and hydraulic gradients.
- **Operations and Serviceability.** Some communities do not have the available resources to operate and maintain an advanced water treatment system. Importing raw water or treated water can help alleviate the concerns with operability and serviceability.
- **Disposal of Waste Streams.** Disposal of waste streams (concentrate) from advanced water treatment facilities creates engineering uncertainties. Local contaminants of concern that will complicate disposal include, but are not limited to, uranium, selenium, and radionuclides.
- **Location.** Construction costs are a key factor in evaluating advanced water treatment versus water importation. Proximity to the nearest viable water source significantly impacts the overall construction cost.



*Pipes discharging (importing) water from the Warren H. Brock Reservoir to the All-American Canal, California.*

*“Treating a locally available, impaired water resource offers advantages over importing fresh water for some applications.”*

Katie Guerra  
Chemical Engineer  
Reclamation’s Lower  
Colorado Region

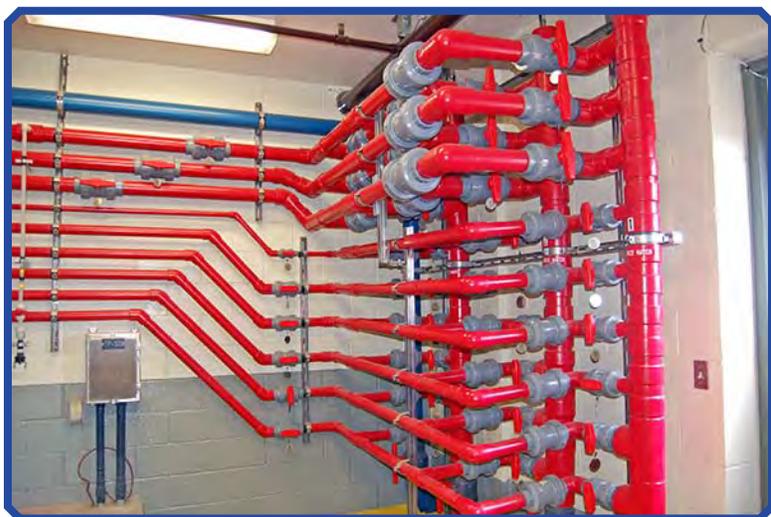
## Future Plans

Results from this research project will be used to help planners evaluate options to meet specific planning goals. Moreover, this project helped identify future research needs in advanced water treatment, so that more communities can treat local brackish water as a viable and sustainable water supply.

## More information

[www.usbr.gov/research/projects/detail.cfm?id=9252](http://www.usbr.gov/research/projects/detail.cfm?id=9252)

*Treated water solutions from the Brackish Groundwater National Desalination Research Facility in Almagordo, New Mexico.*



## Research Update

Winter 2015-2016  
Bulletin 2016-04

### Bottom Line

This research project provided an off-grid solar photovoltaic desalination system to treat brackish groundwater for livestock water, with a further goal to develop potable water for members of the Navajo Tribe who live outside the traditional power and water infrastructure systems.

### Better, Faster, Cheaper

This research could provide closer, cheaper water for people who sometimes drive up to 50 miles to obtain water, and who pay the highest percentage of their disposable income for water.

### Principal Investigator

Mitchell Haws  
(Recently Retired)  
Water Resources Planner  
Phoenix Area Office  
623-773-6274  
mhaws@usbr.gov

### Research Office Contact

Yuliana E. Porrás-Mendoza  
Advanced Water Treatment  
Research Coordinator  
303-445-2265  
yporrasmendoza@usbr.gov

## Solar Photovoltaic Desalination Using Distillation

*Off-grid solar photovoltaic desalination on the Navajo Nation Reservation*

### Problem

The Navajo population live in remote and rural areas where little access to water and power infrastructure exist. Studies report that over 35 percent of the Navajo people live without access to the electric grid and public water systems, haul their potable and livestock water long distances from their homes, and pay the highest price-per-thousand gallons of water. Numerous studies have shown that populations with inadequate water and sanitary services have higher incidents of health problems. An off-grid, inexpensive system is needed to provide closer and cleaner sources of water.

### Solution

To begin addressing the water supply, quality, and quantity problems, a Reclamation Science and Technology Program solar desalination research project was conducted on the Navajo Nation Reservation near Leupp, Arizona. The University of Arizona, a collaborating partner, developed a system that produces up to 1,000 gallons of water per day for livestock consumption. This system uses off-the-grid solar energy to heat and pump water through a distillation desalination system. This research project entailed installing this system to treat the brackish groundwater from a well near the area on the Navajo Nation Reservation where water is needed. This research project provided water for livestock, and the basic knowledge gained from this research will be the foundation for follow-on research to provide potable water.

Steps in the process included:

1. **Assessing Potential Sites.** Well site 5T-529 was selected because of the water quality and its centralized location to the residents, and because it was up on a bluff where this water could be distributed to other locations using gravity without the need of pumping.



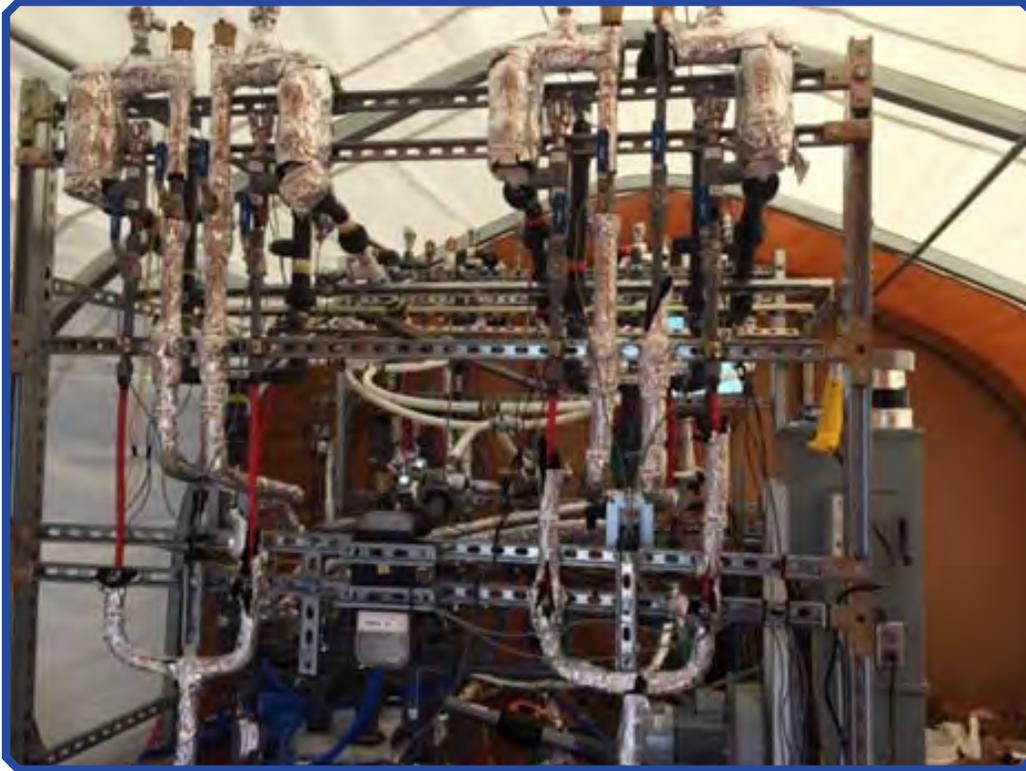
2. **Constructing a Research Facility with a Secure Area for the Research Equipment.** A solar-powered pump was installed into the well and immediately provided an additional water supply for the local livestock. An off-the-shelf Concentrated Photovoltaic-Thermal

— continued

*Solar powerplant.*

Hybrid System solar powerplant produces 5.4 kilowatts of electrical power along with 800,000 British thermal units of heat.

- 3. Constructing and Installing a Desalination Prototype.** On July 10, 2014, the first distilled water was produced with a total dissolved solids (TDS) reading of 5 parts per million.
- 4. Installing Many Monitoring Points to Fine-Tune the System.** System controls are now being developed and will continue under a separate Science and Technology Program research project.



Membrane distillation equipment.

### Application and Results

This off-grid, stand-alone system produced distilled water from brackish groundwater. This system is now in the commissioning stages of the distillation equipment and operational protocols are being developed. The next season of data collection, using the many control sensors, will help optimize the system.

### Future Plans

What researchers learned from this first phase of livestock water production will help with developing a potable water treatment system.

A separate Reclamation Science and Technology Program research project will entail monitoring the water quality data. This research will provide a final report, including a full plan for replication of the desalination equipment.

***“This research project will allow the 150 families in this area of the Navajo Nation much closer access to better quality water. These families now travel to Leupp, or even Flagstaff, Arizona, to obtain their livestock and drinking water. This will reduce their travel time and associated costs. Moreover, this concept can be replicated anywhere in the world where people need better quality water and do not have access to the traditional water and electrical infrastructure.”***

Mitchell Haws  
Water Resources Planner  
Reclamation’s Lower Colorado  
Region

### Collaborators

- Reclamation
  - ◇ Native American Affairs Office
  - ◇ Phoenix Area Office
  - ◇ Provo Area Office
- Navajo Nation Department of Water Resources
- Grand Canyon Trust
- University of Arizona
- Northern Arizona University

### More information

[www.usbr.gov/research/projects/detail.cfm?id=4850](http://www.usbr.gov/research/projects/detail.cfm?id=4850)

[www.usbr.gov/research/projects/detail.cfm?id=6806](http://www.usbr.gov/research/projects/detail.cfm?id=6806)

# Water Prize Competition Center—Launch Calendar

**Challenge.gov**

**Where Brilliant  
Minds Play to Win**



**Pay only for  
performance**

**Discover new talent**

**Stimulate the market**

**Make the impossible  
possible**

**Drive collaborative  
innovation**

**Power ideas into  
reality**

**@ChallengeGov  
challenge@gsa.gov**

## **Theme Area: Water Availability**

### ***Concentrate Management***

May/June 2016

This prize competition seeks new ideas or technologies that can reduce the burden of managing or disposing of concentrated waste streams produced by desalination processes.

Contact and additional prize competition information:

Saied Delegah | 303-445-2248 | [sdelegah@usbr.gov](mailto:sdelegah@usbr.gov)

## **Theme Area: Ecosystem Restoration**

### ***Quantifying Drift Invertebrates in River and Estuary Systems***

Underway

This prize competition sought the public's assistance to find better tools to measure the food sources available for threatened and endangered species.

Contacts and additional prize competition information:

Josh Israel | 916-414-2417 | [jaisrael@usbr.gov](mailto:jaisrael@usbr.gov)

Eric Danner | 831-420-3917 | [eric.danner@noaa.gov](mailto:eric.danner@noaa.gov)

Connie Svoboda | 303-445-2152 | [csvoboda@usbr.gov](mailto:csvoboda@usbr.gov)

### ***Downstream Fish Passage at Tall Dams***

March 2016

This prize competition seeks new ideas for gaining successful and cost-effective downstream fish passage, while minimizing stress and physical damage to fish and providing high fish collection efficiencies.

Contacts and additional prize competition information:

Connie Svoboda | 303-445-2152 | [csvoboda@usbr.gov](mailto:csvoboda@usbr.gov)

Noah Adams | 509-538-2299x254 | [nadams@usgs.gov](mailto:nadams@usgs.gov)

## **Theme Area: Infrastructure Sustainability**

### ***Methods to Identify the Movement of Soils (Internal Erosion) Within Earthen Dams, Canals, Levees, and Their Foundations***

February 2016

This prize competition seeks methods for detecting the movement of particles in earthen structures as internal erosion initiates, or in the early stages of propagation.

Contacts and additional prize competition information:

Peter Irej | 303-445-3033 | [pirej@usbr.gov](mailto:pirej@usbr.gov)

Minal Parekh | [minel.l.parekh@usace.army.mil](mailto:minel.l.parekh@usace.army.mil)

### ***Long-Term Corrosion Protection of Existing Steel Structures***

April/May 2016

This prize competition seeks new or improved methods of corrosion control.

Contact and additional prize competition information:

Bobbi Jo Merten | 303-445-2380 | [bmerten@usbr.gov](mailto:bmerten@usbr.gov)

Jessica Torrey | 303-445-2376 | [jtorrey@usbr.gov](mailto:jtorrey@usbr.gov)

### ***Preventing Rodent Burrows in Canal, Levee, and Dam Embankments***

April/May 2016

This prize competition seeks new or better methods to prevent rodent burrows that damage the structural integrity of canal, levee, and dam embankments.

Contact and additional prize competition information:

Darrel Krause | 303-445-2941 | [dkrause@usbr.gov](mailto:dkrause@usbr.gov)

Rosemarie Spano | 303-445-3165 | [rspano@usbr.gov](mailto:rspano@usbr.gov)

James Dean | 208-378-5398 | [jdean@usbr.gov](mailto:jdean@usbr.gov)

## **Research Office Contact**

Chuck Hennig

Deputy Chief of Research

303-445-2134

[chennig@usbr.gov](mailto:chennig@usbr.gov)

## **More Information**

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

[www.challenge.gov/list/](http://www.challenge.gov/list/)

[www.innocentive.com/ar/challenge/browse?pavilionName=Water&pavilionId=1942&source=pavilion](http://www.innocentive.com/ar/challenge/browse?pavilionName=Water&pavilionId=1942&source=pavilion)



U.S. Department of the Interior  
Bureau of Reclamation

## About *The Knowledge Stream* . . .

*The Knowledge Stream* is the Bureau of Reclamation's Research and Development Office's seasonal 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](mailto: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	<a href="mailto:jmjohnson@usbr.gov">jmjohnson@usbr.gov</a>	208-378-5225
Mid-Pacific (MP)	Jobaid Kabir	<a href="mailto:jkabir@usbr.gov">jkabir@usbr.gov</a>	916-978-5091
Lower Colorado (LC)	Nathaniel Gee	<a href="mailto:ngee@usbr.gov">ngee@usbr.gov</a>	702-293-8029
Upper Colorado (UC)	Mark McKinstry	<a href="mailto:mmckinstry@usbr.gov">mmckinstry@usbr.gov</a>	801-524-3835
Great Plains (GP)	Collins Balcombe	<a href="mailto:cbalcombe@usbr.gov">cbalcombe@usbr.gov</a>	512-899-4162

## Print Options and Instructions

This document is designed to be read either electronically via PDF or printed in color or black and white. Please forward it to your colleagues and friends.

You have three options for printing parts or all of this document:

1. Print individual Research Updates on one sheet of paper, double-sided.
2. Print the whole document double-sided, corner stapled on 8.5- x 11-inch paper.
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 Tyna Petersen at: [tpetersen@usbr.gov](mailto:tpetersen@usbr.gov).

Thanks,

Research and Development Office



# OPEN INNOVATION

**ANYONE** can be a solver for a wide range of expertise or creativity.



**ANY METHOD** can be used to solve the problem.



**FLEXIBLE TIME FRAMES** allow rapid development of ideas.



**MAY SOLVE MANY ISSUES:** a new way to track fish could also be used to track objects in a flood.



# TRADITIONAL AVENUES

**ELIGIBLE CONTRACTORS** are vetted and approved.



**SPECIFIC METHODS** are outlined in the Statement of Work.



**LONGER, COMPLEX TIMEFRAMES** are required for specific acquisition processes.



**SOLVES ONLY ONE SPECIFIC ISSUE:** solutions are evaluated and used only for the specified contract.

