

# RECLAMATION

*Managing Water in the West*



## **FY 2017 Impacts and Highlights**

Science and Technology Program



# About S&T Program

Reclamation's Science and Technology Program (S&T) is managed by the Research and Development Office (R&D). The program is focused on providing innovative solutions for Reclamation water and power facility managers and its western customers and stakeholders, primarily through competitive and merit-based applied funding opportunities for Reclamation employees.

Currently, S&T funds research in five Research Areas: Water Infrastructure, Environmental Issues in Water Delivery and Management, Power and Energy, Water Operations and Planning, and Developing Water Supplies.

S&T also manages Prize Competitions and Technology Transfer activities.

## FY 2017 S&T Research Project Highlights

- 198 Projects
- 119 Lead Researchers
- \$11.1M of Funding Utilized
- \$11.6M Partner Cost Share  
(9 universities, 11 local agencies, 3 tribes, 5 states, 12 federal agencies, 17 private for profit or non-profit partners)



## Learn More

Science and Technology  
<https://www.usbr.gov/research/st>

Prize Competitions  
<https://www.usbr.gov/research/challenges>

Technology Transfer  
[https://www.usbr.gov/research/technology\\_transfer](https://www.usbr.gov/research/technology_transfer)

## Recent Research Results

R&D Knowledge Stream Magazine  
<https://www.usbr.gov/research/ks.html>

S&T Research Bulletins  
<https://www.usbr.gov/research/publications/updates.html>

S&T Research Projects  
<https://www.usbr.gov/research/projects/index.html>



# Water Infrastructure

Dams, Canals, Pipelines, and Miscellaneous Infrastructure

## Electro-Osmotic Pulse (EOP) Technology Stops Water Leaks Through Concrete

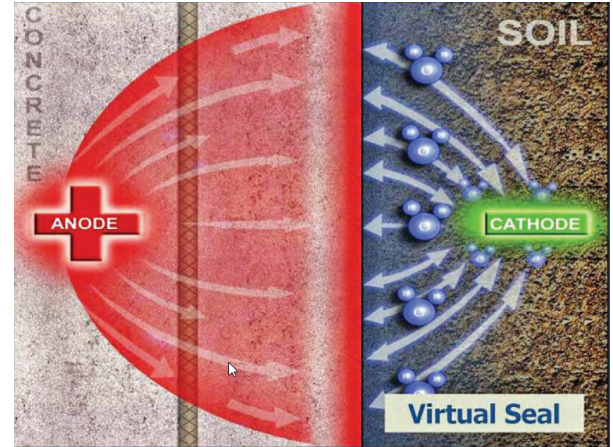
Projected Impact: EOP Technology was developed to control water seepage through concrete by reversing the movement of water, making it capable of drying-out concrete vaults and other high-head structures traditionally plagued with water ingress.

### Summary of Economic Benefits

- S&T Investment \$168,000
- Benefits \$267,000
- Benefit-Cost Ratio 1.6

### Results

- Reduced Maintenance Costs
- Improved Worker Safety
- Greater Infrastructure Longevity



## Using Unmanned Aircraft Systems (UAS) in Managing Rockfall Hazard Areas

Projected Impact: UAS rockfall inspections increase the safety of dangerous rope access team activities and provides improved data, improved mitigation efforts, and better capability to compare data over time.

### Summary of Economic Benefits

- S&T Investment \$290,000
- Benefits \$1,616,000
- Benefit-Cost Ratio 5.6

### Results

- Improved Data Collection at Lower Cost
- Improved Worker Safety
- Better Informed Decision Making







# Environmental Issues for Water Delivery and Management

Water Delivery Reliability, Invasive Species (including zebra/quagga mussels), Water Quality, Sediment Management, and River Habitat Restoration

## Ultraviolet (UV) Light Treatment for Closed-Pipe Quagga Mussel Control

**Demonstrated Impact:** UV light treatment was found to significantly reduce harmful invasive mussel settlement which led to full scale implementation of UV treatment at two powerplants in the Lower Colorado Region. The treatment was found to reduce cooler maintenance yielding a significant time savings, and also has the potential to reduce the risk of unplanned outages at certain facilities.

### Summary of Economic Benefits

- S&T Investment \$222,000
- Benefits \$390,000
- Benefit-Cost Ratio 1.8

### Results

- Reduced Maintenance Costs
- Greater Infrastructure Longevity



## Improved Sediment Monitoring Techniques

**Projected Impact:** Continuous bed load sediment measurement provides critical information that can inform reservoir sediment management and future dam removal efforts where sediment will not be mechanically removed but released downstream.

### Summary of Economic Benefits

- S&T Investment \$851,000
- S&T Investment \$851,000
  - Benefits \$1,200,000
  - Benefit-Cost Ratio 1.4

### Results

- Improved Worker Safety
- Improved Data
- Better Informed Decision Making
- Increased Water Storage or Storage Capacity





# Power and Energy

Hydro Powerplants, Energy Efficiency, Pumping Plants, and Non-hydropower Renewables

## Cavitation Detection Technology for Optimizing Hydraulic Turbine Operation and Maintenance

Projected Impact: Better cavitation detection methods, techniques and instrumentation allows plant operations better flexibility to avoid operating in cavitation producing conditions. These results can be applied to all Reclamation powerplants.

### Summary of Economic Benefits

- S&T Investment \$335,000
- Benefits \$5,730,000
- Benefit-Cost Ratio 17.1

### Results

- Reduced Maintenance Costs
- Optimized and Improved Efficiencies of Existing Hydropower Generation Machinery and Equipment



## Power System Diagnostics - Micro-Ammeter

Demonstrated Impact: This project developed technology that decreases the length of time necessary to identify faults within generators from potentially months to days.

### Summary of Economic Benefits

- S&T Investment \$204,000
- Benefits \$561,000
- Benefit-Cost Ratio: 2.8

### Results

- Reduced Maintenance Costs
- Optimized and Improved Efficiencies of Existing Hydropower Generation Machinery and Equipment

## Power System Safety - Personal Protective Grounds (PPG)

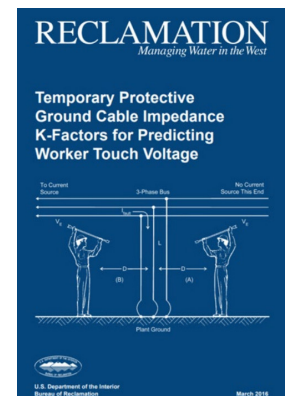
Demonstrated Impact: This project evaluated safe levels of grounding, grounding configurations, and actual voltage exposure for PPG used while working on high voltage equipment. This reduces the potential for severe personnel injuries and creating a safer working environment.

### Summary of Economic Benefits

- S&T Investment \$136,000
- Benefits \$1,000,000
- Benefit-Cost Ratio 7.4

### Results

- Improved Worker Safety
- Avoided Maintenance Costs





# Water Operations and Planning

Water Supply and Streamflow Forecasting, Water Operations Models and Decision Support Systems, and Open Data

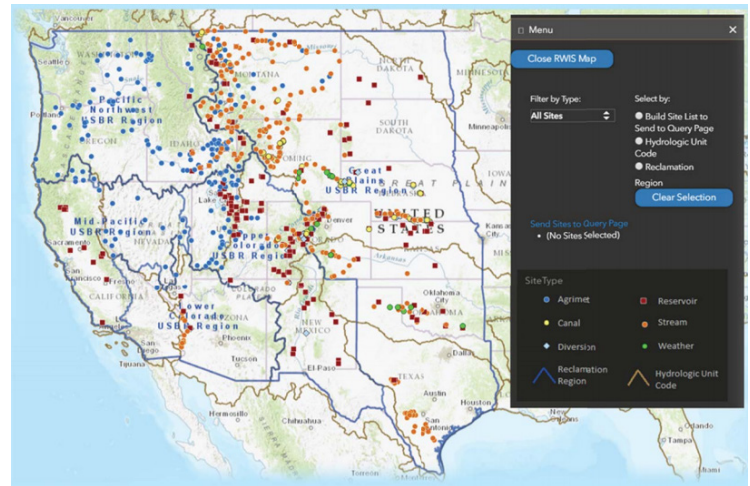
## Reclamation Water Information System (RWIS)

Projected Impact: RWIS offers improved efficiency for fulfilling hydrologic data requests within Reclamation:  
<https://water.usbr.gov/>

- Summary of Economic Benefits
- S&T Investment \$1,020,000
  - Benefits \$10,248,000
  - Benefit-Cost Ratio 10.0

### Results

- Better Informed Decision Making
- More Efficient Data Request Processing



# Developing Water Supplies

Advanced Water Treatment, Groundwater Supplies, Agricultural and Municipal Water Supplies, and System Water Losses

## City of Goodyear Wetlands Project

Projected Impact: Reclamation's S&T program, Title XVI program, and the Lower Colorado Region's Phoenix Area Office have been working with the City of Goodyear, Arizona, to develop a cost-effective and environmentally sensitive advanced water treatment alternative for managing inland reverse osmosis concentrate generated at the City of Goodyear's Bullard Water Campus.

- Summary of Economic Benefits
- S&T Investment \$50,000
  - Benefits \$225,000
  - Benefit-Cost Ratio 4.5

### Results

- Expanding Available Water Supplies
- Meeting Environmental Compliance Requirements







# Prize Competitions

Solving Mission-centric Problems and Accelerating Research through Crowdsourcing

Projected Impact: Prize competitions are a unique tool for addressing elusive mission and operations challenges through private sector and “citizen solvers.” Prize competitions: synergize ideas between researchers brought together from various disciplines and organizations, improve identification of the mission or operational problem and research need, improve understanding of readily available technologies and other research efforts, elevate and increase attention to issues, and create communities of practice around a given problem.

## Summary of Economic Benefits

- S&T Investment in 10 competitions launched FY15-FY17 \$1,040,000
- Benefits \$6,900,000
- Benefit-Cost Ratio 6.4

## Results

- Launched 10 prize competitions addressing Reclamation challenges in infrastructure, water availability and environmental compliance
- Received 350 Solutions
- Awarded prize purse to 51 winning solvers



# Technology Transfer

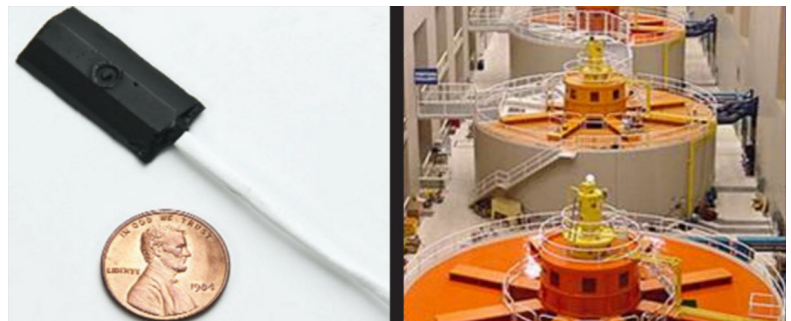
Intellectual Property Protection and Effective Information Dissemination

During FY 2017, 35 technology transfer activities commenced, including:

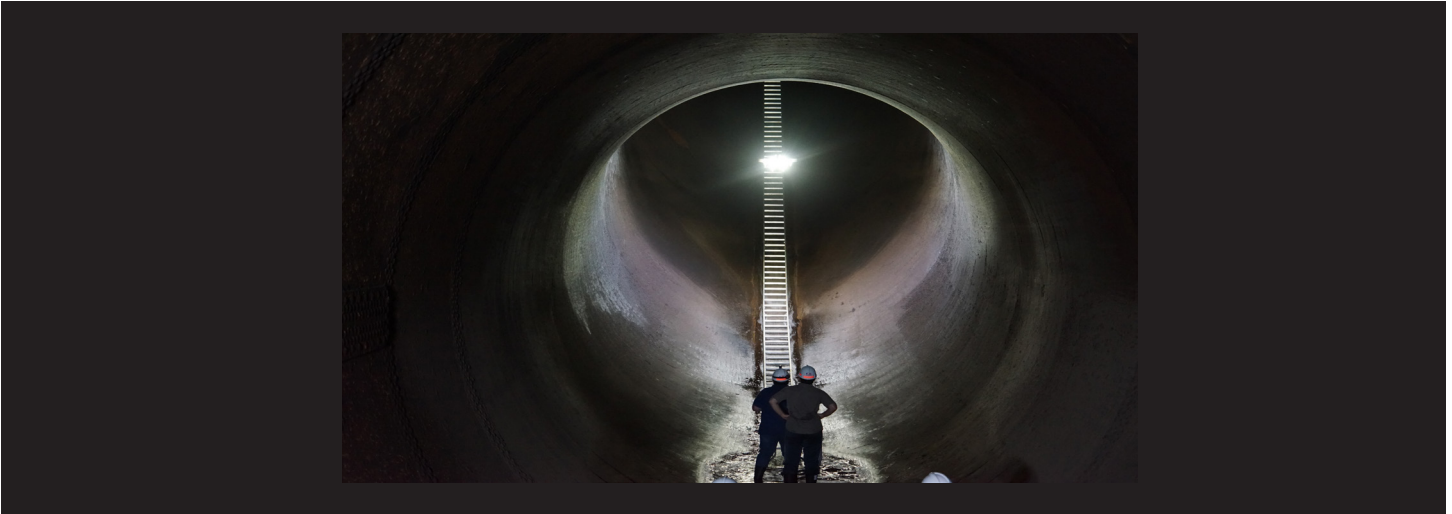
- 5 active Cooperative Research and Development Agreements (CRADA)
- 15 active Material Transfer Agreement (MTA)
- 12 Patents
- 4 Licenses

## Flexible Magnetic Flux Probe

Reclamation also received the *Notable Technology Development Award* from the Federal Laboratory Consortium, Mid-Continent Region, for the Flexible Magnetic Flux Probe (image). The probe was developed by Jim Dehaan, Malin Jacobs and Bert Milano, all researchers of Reclamation’s Hydropower and Technical Services Group.



# More Information



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## About the Covers

**FRONT** - Clockwise from upper left: Hoover Dam, Glen Canyon turbines, and All-American Canal, and Invasive Mussels.  
**BACK** - Autonomous unmanned aerial system testing, one of Reclamation's S&T research projects in FY 2017.