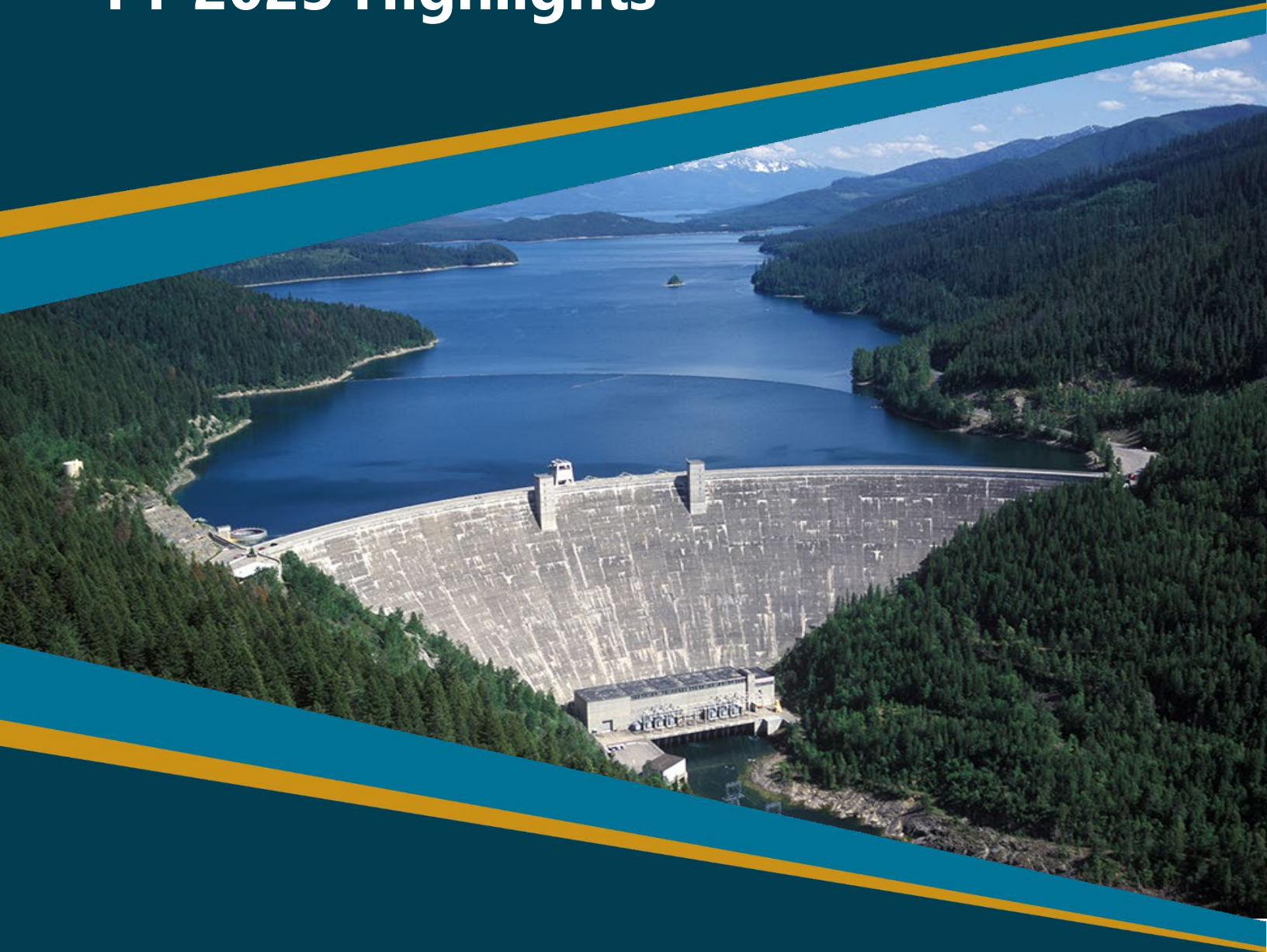




— BUREAU OF —
RECLAMATION

Research and Development Office FY 2025 Highlights



Reclamation's Research and Development Office

The Research and Development Office (R&D) administers innovation programs to advance the agency's mission to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public. R&D's two appropriated programs, Science and Technology and Desalination and Water Purification Research, address the technical obstacles related to our mission. R&D also administers Reclamation's Open Water Data and GIS programs, providing bureau-wide water data publishing and geospatial capabilities to staff. Learn more at: <https://www.usbr.gov/research>.

Science and Technology (S&T) Program

S&T Internal Research

The S&T program funds innovative development, applied and demonstration research addressing the full range of technical issues confronting Reclamation water and power managers, customers, and stakeholders. Program research is funded in five areas:



Water Infrastructure (WI)

Dams, Canals, Pipelines, and Miscellaneous Water Infrastructure



Power and Energy (PE)

Hydro Powerplants and Pumping Plants



Developing Water Supplies (WS)

Water Treatment, Water Supply Augmentation, Groundwater Supplies, Agricultural and Municipal Water Supplies, and Water Losses



Environmental Issues in Water Delivery and Management (EN)

Water Delivery Reliability, Invasive Species, Water Quality, Sediment Management, and River Habitat Restoration



Water Operations and Planning (WP)

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

Internal Research FY 2025 by the Numbers

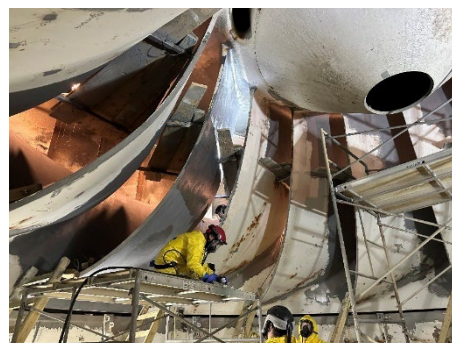
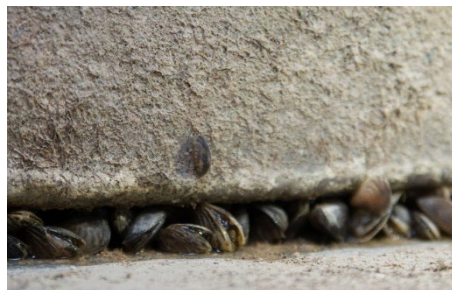
- 152 Active Projects
- 31 Completed Projects
- \$11.1 M New Federal Funding
- \$7.5 M Non-Federal Match



(Top) Project 21049
Monitoring while drilling

(Middle) Mussels (Type?)
(Cover Photo from ZQ
Research Area Summaries

(Bottom) Applying
cavitation resistant coatings
at the Nathaniel "Nat"
Washington Power Plant,
Washington, US from Final
Report for Project 20024



S&T Highlighted Research Projects

(WI) Concrete Cloth for Seepage Reduction- Field Demonstration



Field demonstration of concrete cloth installation to reduce seepage in a canal.

Problem: Reclamation delivers approximately 10 trillion gallons of water annually using an extensive network of canals, infrastructure essential for conveying water across great distances. Seepage from unlined canals represents a substantial source of water loss, exacerbating challenges of water availability and driving up delivery and total water costs. Traditional canal linings require skilled installation crews, advanced preparation, and complex maintenance.

Solution: Concrete cloth, a cement-impregnated fabric with a waterproof backing, represents an effective solution for reducing seepage in canals.

Impact: The concrete cloth significantly decreased water seepage rates when compared to unlined or earthen-lined canals. The technology can be applied to more complex canal geometries, can withstand some settlement, and reduces vegetation growth. Further, the technology is resistant to harsh weather conditions and UV degradation, ensuring long-lasting protection against erosion.

Total Federal Cost: \$0.18M **Benefit Cost Ratio:** 81.4

(PE) Modular Anode Sled Development and Testing for Cathodic Protection of Immersed Steel Structures

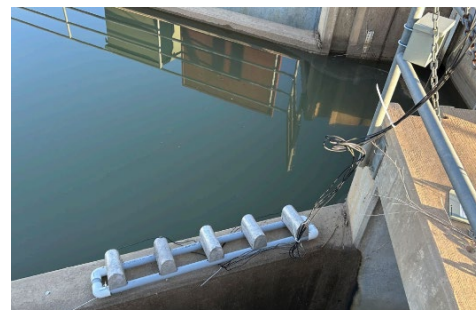
Problem: Steel structures such as gates, trashracks, and pipelines corrode over time when immersed in water. Cathodic protection (CP) represents a means of preventing corrosion, though traditional CP designs often require custom engineering and can be difficult to maintain under water.

Solution: The project team developed a modular anode sled as an alternative to traditional CP systems, where the modular anode sled prototypes were mounted to a portable frame sled that could be lowered into the water and later retrieved.

Impact: Research showed that modular anode sleds are a viable solution for CP of immersed metallic structures, offering effective corrosion protection comparable to traditional systems with added flexibility, ease of deployment, and reduced costs.

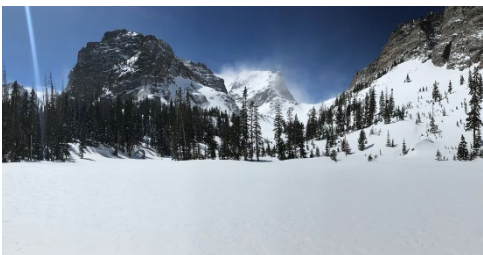
Total Federal Cost: \$0.14M

Benefit Cost Ratio: 1.7



Example of a modular anode sled design.

(WP) Combining Physically Based Snow Modeling and Remote Sensing at High Spatial Resolution to Improve Snowmelt Runoff Forecasts in the Big Thompson and Willow Creek Basins



High elevation snowpack of the Colorado River Headwaters.

Colorado-Big Thompson Project in northern Colorado.

Problem: Traditional runoff forecast methods rely on snowpack information from spatial products with coarse spatial resolution and/or point observations from limited geographic locations, both of which can misrepresent snow conditions across basins with complex topography and underestimate late spring and early summer snow water equivalent.

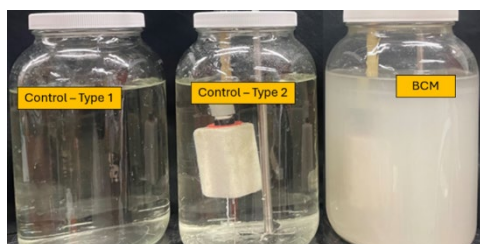
Solution: The study team developed a near real-time modeling system run at a 30-meter spatial resolution across the Big Thompson River, Three Lakes, and Willow Creek Basins, CO, that combines remotely sensed snow-covered area from NASA's Harmonized Landsat Sentinel and a physically based snow evolution model to improve runoff forecast performance, particularly at high elevations.

Impact: Results from this near real time tool are now being used by Eastern Colorado Area Office to inform the streamflow forecasting system used to maintain and operate the

Total Federal Cost: \$0.28M

Benefit Cost Ratio: 3.7

(WS) Biological and Ion Exchange Mining of Reverse Osmosis Concentrate: Enhancing Water and Mineral Extraction from a Salinity Impaired Surface Water



Control and biological concentrate management reactors after an 18-hour test

Problem: Reverse osmosis (RO) is a process used to treat salty and/or agriculturally impaired water sources. The RO process produces purified water and a reverse osmosis concentrate (ROC), a supersaturated brine that presents disposal challenges when natural outlets (e.g., ocean discharge) do not exist. Current methods for treating inland ROC can require constant chemical additions and large amounts of energy.

Solution: Researchers implemented a form of biological concentrate management (BCM), a novel utilization of microbes, to further treat ROC from agricultural drainages.

Impact: In addition to increasing beneficial water reuse, BCM can reduce the volume of ROC, produce pure, monetizable gypsum, mitigate fallowing of farmland, and lower aquifer contamination.

Total Federal Cost: \$0.25M

Benefit Cost Ratio: 20.1

(EN) Investigation of Remote Sensing Tools for Harmful Algal Blooms, Invasive Mussels, and Invasive Aquatic Vegetation

Problem: In freshwater reservoirs, harmful algal blooms (HABs) can reduce the amount of dissolved oxygen and suffocate fish and aquatic wildlife. Invasive aquatic vegetation can clog hydropower structures, impede water flow through canals, and deter recreation.

Solution: Researchers developed a guidance document summarizing seven existing HAB and invasive aquatic vegetation detection tools based on remote sensing technologies to improve Reclamation's ability to detect and respond to these events.

Impact: The resulting guidance document has enhanced Reclamation's ability to monitor HABs via existing, cost-effective remote sensing detection tools. Tools summarized in this work can alert reservoir managers to water quality changes, reduce the need for reservoir closures, and decrease powerplant maintenance.

Total Federal Cost: \$0.14M Benefit Cost Ratio: 1.2



Example of a harmful algal bloom in a freshwater reservoir.

S&T Prize Competitions

Prize Competitions

FY 2025 by the Numbers

- 1 New Competition Launched
- 2 New Competitions in Development
- Up to \$575,000 Cash Prizes Available
- 4 Completed Technology Searches

Reclamation continued to utilize the innovative approach of crowdsourcing through Prize Competitions to identify alternative approaches to challenges encountered supporting Reclamation's mission and stakeholder interests.

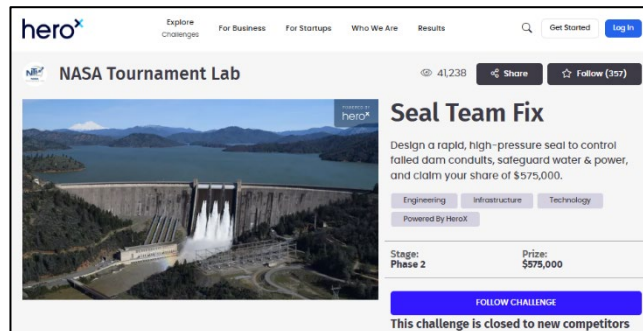
In FY 2025, Reclamation launched one new prize competition, *Seal Team Fix*, under the infrastructure sustainability theme area on the topic of sealing large conduits. This prize competition was developed following a completed technology search in FY 2024 and subsequent need to develop a solution. Initial scoping and development of two new prize competitions planned for launch in FY 2026 are under the infrastructure sustainability and environmental compliance theme areas.

In FY 2025, one competition was launched with the following phases:

- *Seal Team Fix*– Design a rapid, high-pressure seal to control failed dam conduits, and safeguard water and power
- Seal Team Fix calls on engineers, fabricators, inventors, and creative problem-solvers worldwide to design a temporary seal that can be deployed underwater in conduits ranging from 3 to 25 feet in diameter. The solution must withstand high differential pressures and reduce

flow by 95–98% — all without relying on trash racks or other non-structural surfaces for support.

- Up to five participants will share a total prize purse up to \$575,000, progressing through three phases: an initial concept white paper, a funded prototype build, and a lab-scale hydraulic demonstration.
- Visit the website for more information: [Seal Team Fix | HeroX](#)



Seal Team Fix website, available at [Seal Team Fix | HeroX](#)

Reclamation is continuing to work internally and with prize winners to further develop solutions received from completed competitions or technology searched.

Technology searches were identified as an additional tool to help define the problem and solution boundaries for prize competitions. In FY 2025, four technology searches were completed:

- Dissolved Oxygen Mitigation
- Total Dissolved Gas
- Non-native Fish Exclusion
- Water Temperature Mitigation

S&T Facilitated Adoption

Facilitated Adoption FY 2025 by the Numbers

- 7 New Projects
- 18 On-going Projects

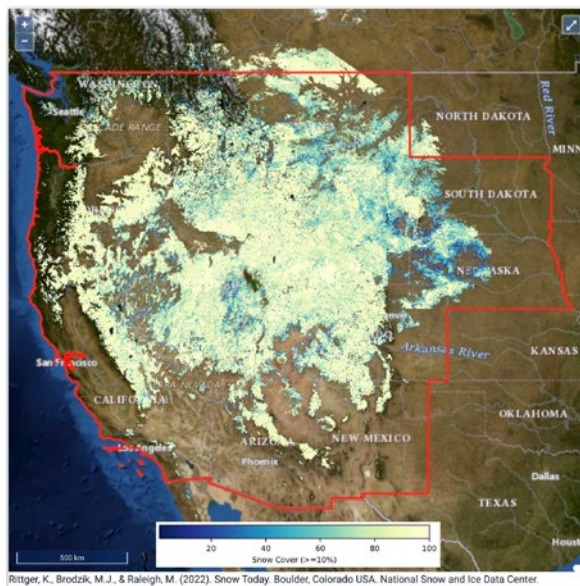
In FY 2025, the R&D Office continued the S&T Facilitated Adoption Program to demonstrate the use of results or transferring knowledge from a completed project to enable the use of the results. Eligible projects are completed S&T Research projects or solutions from Prize Competitions. Seven new projects were selected in FY 2025 for Facilitated Adoption and eighteen projects continued from FY 2024.

S&T Snow Water Supply Forecasting Program

Snow Water Supply Forecasting FY 2025 by the Numbers

- 2 Awarded Cooperative Agreements
- \$1.1M Federal Funding
- 19 ongoing projects

- The Snow Water Supply Forecasting Program Authorization Act, 2020, established the Snow Water Supply Forecasting Program within the Department of the Interior (DOI). The Research and Development office is implementing the Program to advance emerging technologies to enhance snow monitoring and improve water supply forecasts. In FY 2024 the Program:
- Collaborated with federal partners at USDA and NOAA to support the advancement of water supply forecasting technologies. This included developing and awarding 2 projects that enhance federal forecasting agencies' capabilities to utilize satellite-based snow observations in water supply forecasting and enhance operational snow data assimilation modeling and snowpack water volume estimates.



Snowpack in the mountains of Colorado.

S&T Technology Transfer

Technology Transfer FY 2025 by the numbers

- 1 New CRADA
- 5 Ongoing CRADAs
- 1 New MTAs
- 5 Ongoing MTAs

The S&T Program pursues a variety of joint venture research partnership agreements by leveraging Technology Transfer (TT) with the private sector. This includes Cooperative Research and Development Agreements (CRADA), Materials Transfer Agreements (MTA), and Facility Use Service Agreements (FUSA), among others, where industry plays a role in maturing and transforming research results into usable, manufactured products that can be supplied to Reclamation and the broader water management community. For example, Reclamation has partnered with GE Vernova via a CRADA to conduct polymer based add-ons to improve existing hydropower generation flexibility.

Desalination and Water Purification Research (DWPR)

DWPR External Research

DWPR Projects FY 2025 by the Numbers

- 2 Awarded Cooperative Agreements
- \$0.5M Federal Funding
- \$0.3M Non-Federal Match

Reclamation's DWPR Program seeks to reduce the cost, energy consumption, and environmental impacts of using desalination and other water purification technologies to develop water supplies from otherwise unusable sources (e.g., brackish groundwater, seawater, produced water from oil and gas extraction, municipal wastewater). Topics addressed by FY 2025 funded projects and continuing projects funded in prior years include:

- Per- and polyfluoroalkyl substances (PFAS) separation and treatment
- Innovative desalination technologies and methods
- Separation and recovery of nutrients and other valuable byproducts from brine streams
- Novel membrane development and optimization to increase water recovery
- Concentrate minimization and management
- Improved technologies and approaches for water reuse



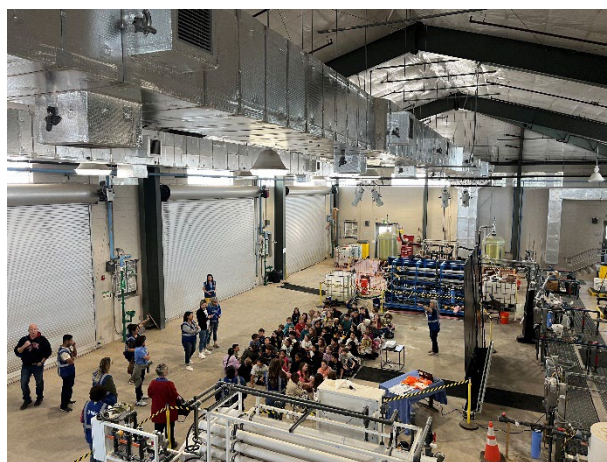
Reverse osmosis vessels at Reclamation's Water Quality Improvement Center in Yuma, AZ.

Brackish Groundwater National Desalination Research Facility (BGNDRF)

The DWPR program funds the operation and maintenance of BGNDRF, located in Alamogordo, New Mexico, a focal point for developing technologies for the desalination of brackish and impaired groundwater found in the inland states. The facility supports piloting and full-scale testing of innovative desalination, water purification, and concentrate management technologies used to increase water supplies.

BGNDRF brings together researchers from federal, state, and local government agencies, universities, private sector, and research organizations to work collaboratively and in partnership. The facility hosted 12 projects in FY2025 with additional projects beginning in FY2026, funded by Reclamation, research consortiums, and private industry.

In January 2026, the facility hosted their eighth annual Water Innovations and Networking (WIN) Workshop with over 85 registrants and presentations from recent clients and Reclamation researchers. The keynote address by Scott Reinert discussed the past, present, and future of El Paso Water.



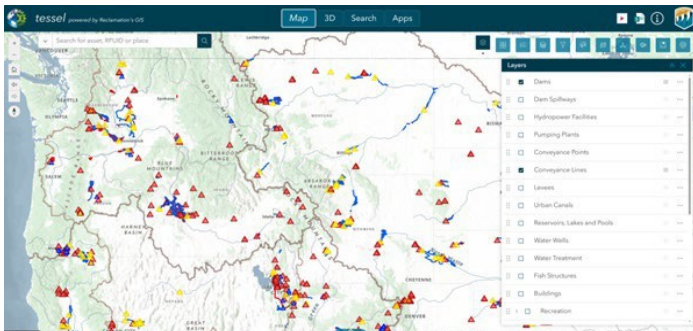
Students attending BGNDRF's Discovering Desal educational event in April 2025.

Data Programs

Geospatial Information Services (GIS)

GIS Program Activity FY 2025 By the Numbers

- 557 actively managed data layers available to Reclamation staff



Reclamation staff can explore curated GIS data and applications through Tessel – your ‘one stop shop’ for GIS resources.

The GIS Program promotes data management principles, enterprise GIS data, a community of practice, and the effective use of geospatial technology to support Reclamation’s mission, our partners, and the public.

FY 2025 Accomplishments:

- Raised awareness: Tessel makes frequently requested GIS data available to all staff including water conveyance, land ownership, land management, reservoirs, dams and more.
- BORGIS responded well to increasing demands: 57 million requests bureau-wide to turn on GIS data, zoom, pan, click, etc.
- Maintained the Reclamation GIS Community with 750 members sharing information via newsletters, webinars, an active ‘Ask a GIS Question’ helpdesk, and GIS office hours.
- Hosted 3 GIS training events to introduce ArcGIS Pro and ArcGIS Online and provided intermediate Google Earth Engine training to help users meet statutory requirements.
- Delivered training to reduce data duplication, ensure reuse with metadata, and comply with the Geospatial Data Act.
- Contributed to the development of MAPLand Act data standards.

Open Water Data (OWD)

OWD Activity FY 2025 By the Numbers

- New datasets published in RISE: 77
- Number of datasets available in RISE: 780 records as of 9/30/2025
- Number of RISE feature updates: 6 releases resulting in 70 changes
- Average Monthly RISE Users: 1171

The Open Water Data Program focuses on making Reclamation’s data available in open formats for broad public use and supports implementation of the OPEN Government Data Act. Program activities include developing, operating, and maintaining the Reclamation Information Sharing Environment system (RISE, <https://data.usbr.gov>) for publishing open datasets, supporting Reclamation data stewards in publishing data in RISE, coordinating with Reclamation staff on open data-related topics through the Open Data Team, and interfacing with external partners to enhance data access and use.

In FY 2025, the Open Water Data Program continued to develop RISE, making it easier for data publishers and data consumers to use. Enhancements included improvements to catalog search logic, deployment of a beta version of a new map interface, form field improvements in the Data Admin UI, and implementation of DCAT metadata output from RISE to allow RISE datasets to be cataloged in the Department’s data inventory and on Data.gov.

Also in FY 2025, the OWD Program supported publication of numerous datasets in RISE, including S&T research reports and datasets, reservoir sedimentation survey reports and area-capacity tables, and Colorado River Basin annual operating plans and 24-Month Study reports. The OWD Program also continued to work with the Internet of Water team at the Center for Geospatial Solutions to develop an interoperable western water data hub and visualization of reservoir conditions.



Front cover photo: Arial view of Hungry Horse Dam, MT

Back cover photo: Hydropower generating units at Glen Canyon Dam, AZ