



FY 2021 Science and Technology Research Projects

Development of a screening, testing, and evaluation framework for the beneficial use of produced water from the oil and gas industry: Funding: \$88,118

This project will develop a screening, testing, and evaluation framework to evaluate the reuse of water used in oil and gas production activities. Pilot testing will be conducted at the Brackish Groundwater National Desalination Research Facility and will be used to calibrate the framework.

Cost and Performance Evaluation of Electrodialysis Reversal Desalination of Brackish Agricultural Drainage Water and Groundwater, Funding: \$111,559

This project will evaluate advanced electrodialysis reversal as an alternative technology to reverse osmosis for the desalination of brackish agricultural drainage water and groundwater. The results of this project will be critical to USBR's Yuma Desalting Plant in Yuma, Arizona, and applicable to other areas considering desalination of brackish water sources.

Factors Limiting Invasive Mussel Establishment at Salt River Project Reservoirs, Funding: \$93,969

This project will collect and analyze water chemistry, hydrology, geology, phytoplankton, and zooplankton data from Bartlett, Roosevelt, Apache, Canyon, and Saguaro Reservoirs, and Granite Reef Dam Forebay to identify habitat variables that may be limiting mussel establishment at Bartlett and Roosevelt Reservoirs and may be influencing sudden declines in mussel populations at infested reservoirs. This research project will provide information that can be included in invasive mussel risk assessments that will be utilized by federal and state resource managers to determine which water bodies are prioritized for monitoring and boat inspections.

Innovative Methods for Invasive Mussel Detection, Funding: \$30,000

This project will identify innovative methods for the detection of invasive mussel veligers to strengthen the ability to detect mussels in a variety of situations and to potentially reduce the costs associated with traditional microscopy analysis.

Use of Copper Ion Generators for Mussel Control at USACE and Reclamation Hydropower Plants, Funding: \$66,700

This project will monitor the effectiveness of the copper ion generator at Big Bend and to gather information about their experience with the discharge permitting process, and other factors that will address Reclamation's concerns about the treatment. Study results will provide a reference for Reclamation hydropower facilities that must consider mussel mitigation strategies.

Voids Behind Spillways, Conduits, Canals, Tunnels, and Siphons: Causes, Detection Techniques, and Repair Options, Funding: \$107,000

This project will determine the causes of voids, void detection methods, and void repair methods. Experts in hydraulics, geotechnical engineering, geophysics, and concrete repair will work together with the goal to improve our understanding of how voids form, how we can best detect voids, and how we can optimize the repair of identified voids.

Analysis of the quagga mussel genome for development of biocontrols, Funding: \$40,000

This work will analyze the genome of the quagga mussel to look for vulnerabilities that could be targeted for genetic biocontrol and to develop tools for pursuing such controls.

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, Funding: \$97,500

This project will enable Eastern Colorado Area Office and Northern Water to improve inflow forecasting to Lake Estes and Willow Creek reservoirs benefiting reservoir operations, water deliveries, hydropower production, balance of supply and demand, and other water management objectives. C-BT project users depend on these forecasts and available project water to plan operations.

Instrumented Standard Penetration Testing (ISPT) to increase accuracy and reliability in penetration and delivered energy data for geotechnical analysis and liquefaction evaluation., Funding: \$99,500

This research looks to improve the Standard Penetration Test (SPT) analysis by digitally recording energy at the sampler and penetration per blow. According the Reclamation Geology Field Manual, the SPT was first created in 1927 as an in-situ geotechnical test for foundation design. The test has opportunities for error that can alter the results. This project proposes to take the lessons and technology developed in the Instrumented Becker Penetration Test (IBPT) program and transfer it to the SPT, with the end goal of developing an off-the-shelf Instrumented Standard Penetration Test tool.

Concrete Cloth for Seepage Reduction – Field Demonstration, Funding: \$110,985

This project will conduct a demonstration of concrete cloth. The goal will be to see if it can reduce seepage of unlined canals. Erosion reduction and reduced maintenance costs are other potential values.

Yakima River Scoping Study to Assess Temperature and Dissolved Oxygen Levels to Inform Water Management Options, Funding: \$29,792

This scoping study seeks to understand the data, tools and models currently available that describe Yakima river water quality, specifically temperature and dissolved oxygen. Project goal is to help advise water managers when flow management options can be used to change water quality conditions to enhance juvenile migration survival and elicit an adult upstream migration response.

Alternate Control Strategy for Dreissinids Using Carbon Dioxide, Funding: \$66,100

This project proposes to investigate the effectiveness and applicability of carbon dioxide under field conditions found in Reclamation facilities. This project also proposes to develop and test the most efficient process for the carbonation of infested flowing raw reservoir water that will prevent veliger settlement and colonization within Reclamation structures

Assessment of Laboratory Methods to Investigate Dreissenid Mussel Veliger Settling in Imhoff Cones Through Dense Organic Material, Funding: \$60,000

This proposal will determine if mussel veligers can settle through water samples that are exceptionally dense or thick.

Optimizing Hydraulic Turbine Operation and Maintenance Through Reducing Cavitation, Funding: \$96,960

This project continued the development and testing of better cavitation detection and monitoring techniques, better inspection and quantification of erosive cavitation damage, improved sensor selection and placement location and signal interpretation for use in the detection and characterization of cavitation and different cavitation types in hydraulic turbines.

Methodology to Determine the Presence of Submerged Hydraulic Jumps at Low-Head Hydraulic Structures, Funding: \$37,772

This project will investigate if known literature can be applied to determine the presence of a submerged hydraulic jump at Reclamation's low-head hydraulic structures. Near-term and long-term mitigation strategies for existing structures can be identified and "safe by design" standards can be created to ensure the new structures are not built that could cause a risk to the public.

Hydraulic Concrete Surfaces for Water Resource Structures – Continued Collaboration, Funding: \$86,000

This research seeks to reduce concrete damage and improve concrete design for both repairs and new projects by evaluating flow interactions with the concrete surface with concrete material properties.

Evaluation of Fiber Optic Technology for Use on Reclamation Critical Infrastructure, Funding: \$97,629

This project will investigate the feasibility and potential use of fiber optic sensing for Reclamation applications with the goal of identifying specific applications for potential future Reclamation research and implementation.

Stakeholder Outreach and Exploration of Dust Mitigation and Suppression Strategies for Exposed Playa at the Salton Sea, Funding: \$55,000

This project will work with stakeholders to prioritize testing of new dust control strategies and develop an approach and methodology that considers the biological, political, and social conditions at the Salton Sea.

Quantifying the Flexibility and Economic Potential of Reclamation's Hydropower Assets, Funding: \$101,500

The proposed research leverages HydrOS and RiverWare to improve system-level hydropower outcomes. Specifically, the research will couple the modeling tools to: (1) identify the maximal operational space for hydropower production for individual facilities (RiverWare); (2) quantify the capability for ancillary services provision and optimal hydropower generation within the defined operational space (HydrOS); (3) evaluate multiple site-specific ancillary services and generation solutions across cascading facilities to deliver system-level optimization (RiverWare).

Assessing the impact of land use and land cover changes on river diversions in semi-arid river basins, Funding: \$73,960

The study proposes to evaluate historical land use and land cover changes (LULCC) by 1) delineating the lands irrigated by diversions based on water rights databases, 2) summarizing annual LULCC within the irrigated lands using historical satellite imagery, and 3) quantifying LULCC over time. The statistical models will be useful in the Boise Project for improving planning hydrology models that simulate water demands and diversions and provide an example of how the geospatial data could be used in other river basins. Better data and statistical models could help inform decision makers and potentially lead to improved system management.

Measurement and modeling of effects of differential wind stress due to topography and wind sheltering elements on hydrodynamics of augmented lakes and reservoirs, Funding: \$100,000

This project intends to develop and test a protocol for long-term measurement and modeling of complex wind fields and water movement in augmented reservoirs using a dense network of meteorological stations, a 3D Computational Fluid Dynamics (CFD) wind model, two Acoustic Doppler Profilers (ADPs), and a 3D computational hydrodynamic model. Incorporating effects of spatially varying winds would improve accuracy of efforts to generate frequency distributions of travel time and attenuation needed for IPR-SWA projects. This will improve the body of information for planning as well as resiliency of drought-impacted water supplies. Lake Arrowhead, CA will be used as a case study to develop a varying wind field protocol for application to steep terrain reservoirs.

Laboratory and Field Testing of Enzyme and Microbially Induced Carbonate Precipitation for Mitigation of Fugitive Dust at the Salton Sea, Funding: \$86,500

Enzyme induced carbonate precipitation (EICP) and microbially induced carbonate precipitation (MICP) are two emerging technologies that offer the potential for sustainable, cost effective mitigation of fugitive dust. The project will result in a demonstration of the efficacy and potential environmental impact of EICP and MICP for fugitive dust control, including the potential impact of residue from agricultural runoff in the Salton Sea playa on the effectiveness of these techniques.

Abrasivity of Slurry-Transported Sediment: Development of a Laboratory-Based Test System, Funding: \$108,000

This research seeks to develop a laboratory-based test method to evaluate the abrasive potential of slurry-mobilized sediment. A project to replace the sludge piping at the Imperial Dam/All-American Canal Desilting Basins are currently underway due to the pipes being deteriorated by the sludge.

This project has a partner from the YAO who will provide soils from this project for testing to demonstrate immediate application potential.

Sediment effects on river restoration habitat features: physical processes and guidelines for effective and sustainable design, planning, and maintenance, Funding: \$73,000

This research will develop guidelines to plan, design, construct, adaptively manage, and maintain habitat features to reduce effects of sediment deposition. This research goes beyond using historical observations to understand how these features evolve over time. Applying sediment transport modeling will provide knowledge of the physical processes governing sediment effects to effectively plan and design habitat restoration to maximize long-term habitat benefits.

Online Monitoring of Protection Systems: Pilot Project, Funding: \$81,000

This project will develop and install online protection system monitoring on two generators, a generator step-up (GSU) transformer and the 125VDC battery system as a prototype system at Glen Canyon Power Plant. The controller would be programmed to continuously interrogate the connected relays, meters and battery monitor to insure near continuous monitoring of the protection system. If deteriorated performance is detected, the Glen Canyon Control Center would receive an alarm.

Cost Estimating Guidelines for Dam Decommissioning Alternative, Funding: \$76,000

This project will develop a cost estimating guideline for dam removals by drawing upon Reclamation and partner dam removal experience. This guidance will not only benefit staff performing technical consultations on dam removals and low-head dam modifications, but will also contribute to dam safety alternative analyses that require dam removal as one possible solution.

Survey and evaluation of dive and aquatic field gear decontamination protocols for preventing the spread of quagga/zebra mussels and other aquatic invasive species, Funding: \$25,000

This scoping project will collect and evaluate existing studies and protocols used by dive and aquatic field sampling organizations to identify existing protocols, assess studies conducted on decontamination protocols that validate their efficacy, and synthesize data to provide recommendations to enhance dive and aquatic gear decontamination protocols.

Standardizing Methods for Disaggregation of Slakable Rock and Fat Clay, Funding: \$69,677

This project will study the variables associated with ball mill processing on a variety of rock and clay materials obtained from active Reclamation projects. The researchers will study the effects of ball size and milling duration on estimated physical properties, study the effects of ball material (e.g., metal vs. rubber) on sand pulverization, and develop a standardized method to process slakable rock and desiccated clay to be adopted by TSC and regional geotechnical laboratories.

Invasive Quagga Mussel Impacts on the Lake Havasu Ecosystem, Funding: \$30,000

This project will improve our understanding of how invasive quagga mussels have impacted the ecosystem of Lake Havasu and the rest of the Lower Colorado River system since their discovery in

2007. Long-term changes to the environment of infested reservoirs poses a threat to recreational sport fisheries, as well as other native fish and wildlife.

**Invasive Mussels and Harmful Algal Blooms: Interactions and Detection Methods,
Funding: \$30,000**

This project seeks to better understand how dreissenid mussels and algae that cause harmful algal blooms interact and what methods can be used in the lab and field to detect them.