2019 Science and Technology Research Projects - Additional Projects Funded

Demonstration of USACE Corrosion Protection System Inspection and Monitoring Advancements, Funding: $52,606
Reclamation has been collaborating with U.S. Army Corp of Engineers (USACE) Engineer Research and Development Center (ERDC) for several years on projects to improve corrosion inspections and corrosion protection and control systems on hydraulic steel structures. This research will facilitate continued collaboration, site demonstrations, and information exchange and allow Reclamation input and access to the exciting tools and techniques that are being developed at USACE.

Improving distributed hydrologic models using multiscale thermal infrared, near infrared, and visible imagery from sUAS and satellite-based sensors, Funding: $47,220
In areas of complex topography and vegetation, distributed hydrologic models are often used to simulate runoff and other watershed conditions. One challenge of applying these models is that relatively high-resolution data are required to adequately generate parameters and effectively calibrate the model. Remote sensing offers a new opportunity to consider a range of fluxes and variables at high resolution in model calibration and parameter estimation. Small unmanned aircraft system (sUAS) allow for higher temporal (subdaily) and spatial (< 1 cm – 1 m) resolution than traditional satellite imagery. Here, we propose applying sUAS remotely-sensed thermal infrared data to evaluate the opportunity of using land surface temperature for model calibration.

The anticipated outcomes of this project include an improved hydrologic model for the area of interest, additional data that can be used for model improvements such as vegetation characterization, and documentation of the added value of remotely sensed land surface temperature for model calibration.

Electronic Geologic Logging, Funding: $30,000
It is becoming more and more common to utilize tablet computers in field work applications. Reclamation's geologic investigations stand to benefit from this technology in terms of shorter turnaround time for final drill logs, increased quality of data, and fewer overall staff hours spent producing logs. This research, which has very broad TSC and Regional office support, will evaluate a variety of commercial e-logging products and perform trial implementations of the most promising during upcoming field investigation activities.

Adhesion Strength of Protective Coatings – Test Method Development under Real-Life Hydraulic Conditions, Funding: $80,000
This study is investigating more reliable test methods for protective coating to address a need for a more dependable test method of coating adhesion strength. Test results from existing methods do not accurately predict adhesion strength under real-life hydraulic conditions. The purpose of this study is to conduct testing under "real-life" conditions with high-speed flows and develop a new test method from the results.

This study will be conducted in collaboration with the Center for Corrosion Science of the US Naval Research Laboratory.

Monitoring the Movements of Juvenile Pacific Lamprey in the Yakima River using Acoustic Telemetry, Funding: $72,400
This proposal addresses the lack of information about juvenile (i.e. macrophthalmia) Pacific Lamprey migration movements and survival by conducting an acoustic telemetry study. A new acoustic transmitter, designed specifically for use in lampreys and eels, has been developed by the Pacific Northwest National Laboratory (PNNL) using the Juvenile Salmon Acoustic Telemetry System (JSATS). Based on preliminary results from a pilot-test in 2017 in the Mid-Columbia River (upstream of John Day Dam), the tag performance was outstanding (98-100% detection at each of the three receiver stations).This salmon survival study will have a large array of JSATS receivers installed in the lower Yakima River to monitor fish migration past Reclamation diversion dams, and the arrays will be compatible with the newly developed lamprey tag. This collaborative approach will serve the dual functions of field testing of the innovative lamprey transmitter in the tributary and mainstem environment and providing valuable insights into lamprey migration behavior and passage bottlenecks that will be applicable region wide (Columbia River Basin, tributary subbasins, and beyond).

Pilot testing of renewable-energy powered desalination systems in the Navajo Nation for small and rural communities, Funding: $115,452
This project will leverage past S&T and Desalination and Water Purification
Research (DWPR) research to demonstrate the feasibility of treating brackish groundwater for potable use from a remote well site using renewable energy. While a significant amount of research over the past 15 years has led to technological advances in renewable energy powered desalination; this technology has not been successfully implemented as a water supply solution for communities with the greatest need. This project represents a unique opportunity to leverage the past research and experience gained with a real-world application to develop a framework for the implementation of an integrated, holistic approach to the supply of water with consideration for the social and cultural setting in which the technology will be used.

The research proposed here has the potential to increase power and water supplies in rural and Native American communities and could be transferable to other communities with similar conditions. The results of this research could lead to the development and implementation of watering stations consisting of renewable energy powered treatment systems that could be incorporated into future water development in lieu of other infeasible expensive pipeline projects. Furthermore, it is anticipated that this process is scalable to develop larger quantities of brackish water to serve regional water demands.

Using Remote Sensing and Ground Measurements to Improve Evaporation Estimation and Reservoir Management, Funding: $151,000
Evaporative losses from reservoirs can be considerable, especially in the arid Southwest. Weather conditions, size and shape of a reservoir, and reservoir operations all contribute to uncertainty in estimating reservoir evaporation losses. Improved understanding and quantification of these losses may offer insights for reservoir operations that may reduce these losses. The current method(s) used to estimate and account for evaporative losses rely upon technology from a century ago (i.e. class A Evaporation Pan) and area-capacity tables for individual reservoirs. Technological advances using remote sensing (e.g. Landsat-8 satellite) and highly sensitive instrumentation (i.e. 3-D sonic anemometer with hygrometer, infrared sensors, high frequency data collection, etc.) have shown the potential to be used in estimating evaporation losses with more accuracy. This project will pursue use of these technologies with reservoir bathymetry, remote sensing, and simple yet robust sensors deployed onshore and offshore.

The research is in partnership with Reclamation UC Region, New Mexico State University, New Mexico Office of State Engineer, New Mexico Interstate Stream Commission, New Mexico State Parks, and Elephant Butte Irrigation District (EBID).

Software Tool Development to Generate Stochastic Hydraulic Simulations using HEC-RAS, Funding: $75,00
HEC-RAS is an industry standard hydraulic model developed by the Army Corps of Engineers (USACE) that is used to analyze rivers and hydraulic system to determine channel conditions such as water surface profiles, instream velocities and depths, and boundary shear stress.This project will develop software for performing Monte Carlo simulation on input parameters in HEC-RAS.This functionality is important due to large uncertainties associated with these input parameters. This project will enable hydraulic modeling results to be presented as probabilities associated with stochastic simulation, rather than one deterministic value. Development of this resource will be in coordination with USACE to facilitate adoption in the HEC-RAS software.

Can better representation of low-elevation snowpack improve operational forecasts?, Funding: $94,564
Throughout the Western U.S., sparse observations and variable weather make snowmelt runoff volume and timing hard to predict. In Reclamation's Great Plains Region, errors in model-based streamflow forecasts during the spring runoff season limit water managers' ability to optimally manage reservoir systems, particularly in years with extreme runoff conditions. One hypothesis for forecast errors is that models do not capture snowmelt events from low-elevation snowpack well. The case study for this research project is Reclamation's Boysen Reservoir in Wyoming, where forecast errors have also created operational challenges. This proposal investigates if advances in observations and model representation of snow across elevations can improve forecast skill. Increased forecast skill will provide operators with better information to make decisions and mitigate or avoid impactful events like the 2018 Milk River floods.

Exploring the use of temperature to understand recent drought and project future conditions in the Colorado River Basin, Funding: $90,000
Reclamation provides midterm (2- to 5-year) reservoir operations projections for the Colorado River Basin (CRB) that are important to both Reclamation's and stakeholders' planning. Currently, the flow distribution of the past 35 years is used to represent the next 2-5 years. This study will explore work to date on CRB flow temperature sensitivity to assess spatial/temporal variations in run-off temperature sensitivity. Building upon that, this work aims use emergent multi-year temperature forecasts to improve flow projections used in mid-term operations projections. This project is being conducted by Reclamation's UC and LC Regions in collaboration with the National Center for Atmospheric Research (NCAR), the University of Colorado, Central Arizona Project, Colorado River Board of California, Denver Water, and Southern Nevada Water Authority.

Reducing Hydropower O&M through improved Excitation and Governor Control, Funding: $200,000
This project will develop a new, cost effective, and flexible excitation and governor control system for small to medium size hydropower generation facilities using commercial off-the-shelf hardware and open source programming tools, thereby reducing hydropower O&M and training costs.

Spring Heat Wave Prediction for Snowmelt Management, Funding: $200,000
This project is in partnership with Scripps Institution of Oceanography to undertake an assessment of spring heat waves toward enhanced predictability at the seasonal to sub-seasonal timescale (~3 to 12 week lead times). Heat wave research to-date has focused mainly on the summer season and impacts to public health and other sectors. From a western water management perspective in snowmelt dominated basins, spring heat waves are especially impactful for timing and other run-off characteristics. Improved prediction of runoff timing and magnitude would offer reservoir management benefits to both flood control and water supply objectives.

Additive Manufacturing Investigation and Demonstration for Hydropower Applications, Funding: $222,832
This project will partner with DOE's Manufacturing Demonstration Facility at Oak Ridge National Laboratory to improve reliability and decrease outage time at hydropower facilities by exploring the use of 3D printing/additive manufacturing and advanced materials to manufacture parts and components where no drawings exist or the part is no longer manufactured. Candidate components include governor parts, circuit breaker parts, and others.