

REQUEST FOR PROPOSALS
University of Wyoming Office of Water Programs
Water Research Program
FY2020

The Office of Water Programs/Water Research Program welcomes proposals covering a wide range of topics involved in Wyoming's water resources. Each proposal shall include a "Non-technical Statement of Relevance" explaining how the study could be used by governmental agencies in the management of Wyoming's water resources, will meet the research needs of State and Federal agencies regarding Wyoming's water resources, and support water related training and education.

Dam Operation and Sediment Management and Transport

The accumulation of sediment in stream systems and behind dams presents challenges. Effective dam operations require the ability to meet water user needs while still protecting downstream uses (e.g., fisheries, aquatic life). Additional research is needed to help understand how to prevent heavy sediment releases and how to effectively respond when they occur. Areas of research include, but are not limited to:

- Additional studies describing the fate and transport of sediments in Wyoming's erosive watersheds and what measures can assist with reducing sediment inputs.
- Further studies on using "flushing flows" to address downstream sediment deposition following releases.
- Studies on economically feasible ways to remove sediment accumulated behind dams.
- Information on ways to most effectively manage sediment at dams and reservoirs to protect and maintain downstream surface waters.
- Best management practices (BMPs) for reducing sediment transport from contributing watersheds.
- Studies evaluating the negative impacts of sediment deposition on land use and land features, such as rangelands and wetlands.

Proposals may build on the current Water Research Program Project, *Sediment and Fisheries: An Assessment to Inform Sediment Management Practices at Wyoming Dams*, or other existing sediment studies in the State of Wyoming. Proposals having a broad applicability to dams statewide are encouraged as well.

Enhanced Water Supply Forecasting and Water Use

The Wyoming Water Strategy identified the need to better understand watershed, atmospheric, and climatic variables and their effects on streamflows and water supply, as well as the need to update, improve and/or develop water supply forecasts in river basins of Wyoming. Additionally, improvements on methods for estimating current and historic consumptive use in multiple areas of the state would be useful.

Areas of research include:

- Construction or evaluation of existing flow forecasting tools that analyze the response of various combinations of climate, water demand and land use on streamflow as well as general watershed hydrology. Particular emphasis should be placed on:

- Calibration of forecasting tools in hybrid plains/mountain streams with highly variable climates during low flow years. This could include an evaluation of temperature predictions in relation to water demand factors as well as research aimed at enhancing understanding of transitional zones (i.e. foothills that typically receive intermittent to seasonal snowpack) and lower-elevation (i.e. high plains) contributions to streamflow. Two examples of basins of interest in Wyoming that have large datasets that can contribute to the initiation of research are the Tongue River and Upper North Platte River Basins.
- Use of geospatial models and statistical analyses to better understand the important drivers of streamflow (including drivers that determine whether a stream is intermittent or perennial in a given basin) in small stream basins (<50 square miles).
- Developing and/or testing accuracy of various techniques for estimating streamflow variables, such as mean monthly flows and exceedance flows, in small, ungauged basins.
- Research in support of using remote sensed data in the evaluation of the extent of snowpack and snow water equivalent and resulting streamflow.
- Identification of areas in Wyoming where additional snow and/or climate instrumentation would benefit water supply forecasting.
- Identification of areas of consistently larger seasonal runoffs for potential siting of future water developments.
- Development of tools that would allow Wyoming to take advantage of emerging remote sensing technologies to determine current and historic consumptive use.

Groundwater Analysis/Aquifer Potential Characterization

This topic seeks research that attempts to address the challenges of measuring and allocating groundwater in areas of growing population and declining groundwater resources.

Research regarding the integration of recognized modeling techniques with existing hydrogeologic and geophysical measurements to understand aquifer reservoir properties and dynamics is needed. Priority is given to the application of digital/numerical/statistical tools that increase knowledge of groundwater basin aquifer systems and recharge areas of the State.

Protecting Public Health

Wyoming citizens and out-of-state visitors enjoy fishing, boating, swimming, floating, and other recreational opportunities provided by Wyoming's lakes, reservoirs, rivers and streams. However, recreational activities, particularly those that result in full-body immersion, can pose a risk to public health if individuals are exposed to pollutants in the water that cause adverse health effects. Proposals may build on the current Water Research Program Project, "*Understanding the Contribution of Different Microbial Sources to Surface Water for Informed Management of Waterborne Pathogens in Wyoming*".

- **Water borne pathogens** (as typically measured by the indicator *E. coli*) cause the majority of Wyoming's surface water quality impairments. Research addressing pathogens is of significant importance to the State of Wyoming. Additional tools are needed to better allow state and local water managers, regulators, conservation groups, and others to minimize public health risk by 1) better assessing and prioritizing public health risk, 2) identifying sources of pathogens, and 3) identifying effective management measures to reduce

pathogens and mitigate public health risk. In particular, the following topics are identified as priority research areas:

- Studies related to evaluating the ability of indicators other than *E. coli* (e.g. enterococci, coliphage) to accurately assess public health risk from waterborne pathogens in Wyoming waterbodies.
 - Studies related to the fate and transport of pathogens (particularly *E. coli* as an indicator) in the environment.
 - Studies related to the ability of pathogens (particularly *E. coli* as an indicator) to survive and persist in streambed sediment and how this relates to assessing public health risk.
 - Epidemiological studies relating pathogen levels to incidence of water borne pathogen exposure and illness in Wyoming streams and rivers.
 - Studies using Microbial Source Tracking (MST) to determine various sources contributing pathogens to surface waters.
 - Studies that evaluate the effectiveness of conservation practices in reducing pathogen (*E. coli*) loading to surface waters.
- **Nutrients** (nitrogen and phosphorus), in appropriate amounts, are essential to healthy aquatic ecosystems. However, excessive nutrients, or nutrient pollution, can lead to harmful cyanobacteria blooms (HCBs) in lakes or reservoirs. HCBs are dense concentrations of cyanobacteria or blue-green algae that pose a risk to human, pet, and livestock health. HCBs can produce poisons called cyanotoxins and may be associated with other irritants that can cause adverse health effects such as rashes, itching, numbness, nausea, fatigue, disorientation, abdominal pain, vomiting, and diarrhea. In extreme cases, cyanotoxins may lead to pet or livestock death. HCBs can also cause fish kills and interfere with drinking water supplies. Recreational use health advisories were issued on twelve (12) Wyoming reservoirs in 2018 due to HCBs. Research on nutrient pollution and HCBs would help state and local entities better identify, assess, and respond to HCBs in order to reduce public health risk from exposure to cyanotoxins and other cyanobacteria-related irritants. In particular, the following topics are identified as priority research areas:
 - Studies related to the fate and transport of cyanotoxins and other compounds associated with cyanobacteria blooms.
 - Studies evaluating the effectiveness of conservation practices or advanced treatment septic systems in reducing nutrient loading to surface waters.
 - Studies on the types and levels of toxins (or other compounds causing health effects) in cyanobacteria blooms in Wyoming surface waters.
 - Studies to identify target nitrogen and phosphorus concentrations to prevent unsafe densities of cyanobacteria.
 - Studies evaluating the health risks to humans, pets, livestock and wildlife associated with cyanobacteria blooms with and without toxins.
 - Studies related to the presence of benthic cyanobacteria blooms and potential toxin production in streams and rivers.
 - Studies evaluating the use of remote sensing techniques to identify and quantify cyanobacteria blooms.
 - Studies evaluating the risks of using irrigation water from lakes and reservoirs where HCBs are occurring.

Conveyance Losses

Conveyance efficiency is of considerable interest to irrigators and water resource managers since it can significantly affect the amount of water delivered to the point of use (crop) from the diversion. To better develop hydrologic models meant to determine volume, location, and timing of irrigation shortages and available water for development, water developers desire to have a better understanding of conveyance efficiencies in various settings. The project objective would be to evaluate available conveyance loss studies on river/stream systems and conveyance ditches/canals, to provide information that could be applied to hydrologic models developed throughout the State.