REQUEST FOR PROPOSALS
University of Wyoming Office of Water Programs
Water Research Program
FY2019

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 behind dams presents challenges to their effective operation to meet water user needs while still protecting downstream uses (e.g., fisheries, aquatic life). In the fall of 2016, over 90,000 cubic yards of sediment were released from behind Willwood Dam. The majority of this sediment was deposited on the downstream Shoshone River channel bed, affecting fish populations and aquatic life. This release event has prompted local, state, and federal agencies and organizations to work together to address impacts of the 2016 release and develop tools to prevent such events from occurring in the future. For example, in response to the 2016 Willwood Dam event, the University of Wyoming completed a study to help determine the potential to use "flushing flows" to hydraulically remove the deposited sediment in the Shoshone River below the dam. Additional research is needed to help understand how to prevent such releases and to effectively respond when they occur. Areas of research include, but are not limited to:

- Additional studies that describe 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.

Proposals may be specific to a particular dam, such as the Willwood Dam. However, studies that have broader applicability to dams statewide will be more competitive.

Water as a Driver for Economic Diversity in Wyoming

In February 2017 the Wyoming Legislature voted to fund the Economically Needed Diversity Options for Wyoming (ENDOW) initiative. It is an effort to develop a 20-year comprehensive and coordinated economic diversification strategy to bolster the state's economy and provide a cushion against the inevitable ebbs and flows of the energy markets. Significant efforts put forth by the Wyoming Water Development Office have focused on opportunities to develop water to meet existing and projected needs within the State. Knowledge could be gleaned to evaluate additional opportunities where Wyoming's water can contribute to the State's economic growth under today's legal and regulatory framework (i.e. Wyoming water law, interstate compacts and court decrees, etc.). Research under this topic should:

Evaluate the role of Wyoming's water in community development, including the expansion of economic sectors with a current presence in the State, as well as the attraction/retention of new sectors to our economy.

- Develop methods to enhance clean and reliable water that stimulates direct, indirect and induced economic impacts, as well as the valuation of water's contribution to sustained growth of gross regional product, job creation, per capita income and labor force participation.

Water Supply Forecasting

The Wyoming Water Strategy identified the need to better understand atmospheric and climate variables and their effects on water supply, as well as the need to update, improve and/or develop water supply forecasts in river basins of Wyoming. Areas of research that would assist in this initiative 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 the 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.
- Development of localized crop coefficients appropriate for use with a Penman-Monteith based consumptive use methodology. Research in support of using remote sensed data in the evaluation of the extent of snowpack and snow water equivalent, and resulting streamflow would also support this initiative.
- Identification of areas of Wyoming where additional snow and/or climate instrumentation would benefit water supply forecasting.
- Identification of areas of consistently larger seasonal runoffs for potential siting for future water developments.

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/numeric/statistical tools to explore localities or existing well fields to increase knowledge of key 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. Areas of study include:

- **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 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 *E. coli* levels to incidence of water borne pathogen exposure and illness in Wyoming streams and rivers.
    - Studies related to evaluating the ability of indicators other than *E. coli* (e.g., enterococci, coliphage) to accurately assess public health risk from water borne pathogens in Wyoming waterbodies.
    - 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 algal blooms (HABs) in lakes or reservoirs. HABs are dense concentrations of cyanobacteria or blue-green algae that pose a risk to human, pet, and livestock health. HABs 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. HABs can also cause fish kills and interfere with drinking water supplies. Two recreational use health advisories were issued on Wyoming reservoirs in 2017 due to HABs. Research on nutrient pollution and HABs would help state and local entities better identify, assess, and respond to HABs 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 on the types and levels of toxins in cyanobacteria blooms in Wyoming surface waters (i.e., relating densities of cyanobacteria blooms to toxin levels).
    - Studies evaluating the public health risks associated with cyanobacteria blooms with and without toxins.
    - Studies related to the fate and transport of cyanotoxins and other compounds associated with cyanobacteria blooms.
    - 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 health effects of cyanotoxin and cyanobacteria in pets, livestock, and wildlife.
- Studies evaluating the health effects of consuming fish that have been exposed to cyanobacteria blooms and/or cyanotoxins.
- Studies that evaluate the effectiveness of conservation practices or advanced treatment septic systems in reducing nutrient loading to surface waters.

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 study objective would be to evaluate conveyance efficiencies of a variety of river/stream systems and/or ditch/canal sizes in a variety of soil conditions, geographic locations, and settings during various times of the year in an attempt to develop general efficiency information that could be applied to hydrologic models developed throughout the State when specific ditch information is unavailable.