REQUEST FOR PROPOSALS
University of Wyoming Office of Water Programs
Water Research Program
FY2017

The UW Office of Water Programs invites faculty members and affiliates of the University to submit research proposals under the FY17 Wyoming Water Research Program. Proposals responding to the research areas described in the accompanying RFP are sought.

Proposal submission due date: Monday, Oct. 3, 2016, by 5:00 P.M., Room 203 WYO Hall.
Tentative project start date: March 1, 2017.

All researchers interested in submitting proposals must contact the Director of the UW Office of Water Programs for formatting requirements, mandatory Excel sheet for preparing budgets, submission guidelines, and other information.

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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 detailed explanation of how the study (i) will encourage the development of water facilities, (ii) will facilitate the planning, selection, financing, construction, acquisition, and operation of projects and facilities for the conservation, storage, distribution and use of water; (iii) could be used by any governmental agencies in the management of Wyoming's water resources, and (iv) will meet the research needs of State and Federal agencies regarding Wyoming's water resources.

Reservoir Expansion – Wetland Issues/Opportunities

Governor Matthew Mead has issued a State of Wyoming document "Leading the Charge: Wyoming Water Strategy." This document outlines 10 initiatives over 4 themes. Theme 2, Water Development Initiatives 4, 5, and 6 relate to existing and new reservoirs while initiative 7 aims to develop collaborative planning and authorization processes, thereby creating a modular framework for information sharing, planning, and decision making.

The high priority placed by the Governor on reservoir projects would be facilitated by research that enables reservoir projects to develop in a more efficient manner. Research, focused on reservoir expansion, which investigates developing or enhancing wetland community structure and function associated with periods of high inundation and subsequent draw-downs is desired. Enlargement of reservoirs with fringe wetlands typically triggers NEPA (National Environmental Policy Act) and 404 permit requirements due to the potential degradation or loss of jurisdictional wetlands. For reservoir expansions to be feasible, existing wetlands either have to be maintained or mitigated, sometimes at ratios that make the project infeasible. However, it is known that wetland vegetation has varying tolerances to depth and duration of inundation. Therefore, it may be possible to enlarge reservoirs, perhaps only nominally, without significantly impacting existing wetlands through the use of water management, draw-down timing, and growing season. In some instances, there may be opportunity to expand, mitigate, and/or enhance the functionality and value of wetlands.

Climate, Weather, and Stream Flow Data

The document "Leading the Charge: Wyoming Water Strategy" addresses the need for more credible climate, weather, and stream flow data. This initiative has two objectives (1) identify, prioritize and make recommendations for additional data instrumentation needed to address regional issues and (2) the creation of online data tools that allow easy access to important data sets and background maps. To fulfill this initiative, research is needed concerning the feasibility of expanding Wyoming's current weather station network statewide. Currently, only few parts of the State contain full-fledged agricultural weather stations capable of providing data required for water forecasting and planning. An analysis of where weather stations could be placed throughout the State to give the best coverage of the State's irrigated agriculture would benefit both the State and water users. Another area of research that would benefit this initiative is a study on determining if existing crop coefficients for evapotranspiration calculation at high elevations are up-to-date and

based on the latest state of the art information. Developing crop coefficients for grass hay and alfalfa at high elevations would benefit the State in being able to better determine water consumed by the crop, and thus being more equipped to meet interstate water compacts and decrees. Along with determining crop coefficients is the need for more remote sensing in the area to collect the data needed to fulfill the initiative. This includes research using remote sensing on snowpack and snow water equivalents, evapotranspiration, crop type determination, etc. The data gathered using remote sensing will be essential to meeting the requirements of this initiative.

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. New or improved water supply forecasts should model all innovative scientific research and data collection related to snowpack, climatology, stream gaging, etc. The majority of all seasonal runoff in Wyoming begins as snowpack and contributes greatly to water supplies.

Areas of research that would assist in this initiative include:

- Utilize remote sensed snowpack data by MODIS, Airborne Snow Observatory, Ground Penetrating Radar, etc. and construct a water supply forecast utilizing the latest technology with remote sensing.
- Identify areas of Wyoming where additional snow and/ or climate instrumentation would benefit water supply forecasting.
- Construct models detailing monthly water supply forecasts related to interstate compacts and decree delivery obligations.
- Improve the accuracy of current run-off models by incorporating any new modeling techniques and/or information.
- Identify areas of consistently larger seasonal runoffs as a potential site for future water developments.

River Restoration

River restoration is an initiative included in Governor Mead's Wyoming Water Strategy (2015). This initiative notes how our understanding of river processes has improved significantly over the past 50 years. In addition, practices have been developed that can be employed to manage rivers for greater utility and benefit. The purpose of this initiative is "…to develop strategies, financial tools, technical expertise, and collaborative agreements that further stream restoration efforts throughout Wyoming." Areas of research that would assist with this initiative include:

- Approaches to river restoration in urban environments.
- Tools to assess the effectiveness of restoration efforts.
- Evaluations of long-term economic benefits of river restoration.
- Financial tools to fund river restoration projects along with post-construction monitoring.
- Lessons learned from past projects to improve the success of future projects (post-construction monitoring will help address this item).
- River restoration in response to post-wildfire flood events.
- Consideration of drought and climate variability as part of river restoration.
- Approaches to combine river and wetlands restoration.
- Benefits to fisheries from river restoration.

- River restoration to mitigate impacts from water storage projects.
- River restoration techniques that improve and support irrigation needs and infrastructure.
- Use of remote sensing technology to better understand fluvial geomorphology.
- Use of hydraulic modeling tools for river restoration.

Energy-Plan Strategy for Produced Water

Governor Matthew Mead has issued a document "Leading the Charge: Wyoming's Action Plan for Energy, Environment and Economy." In this document, 16 strategies are listed. Innovative Water Treatment and Management Incentives is listed as Strategy 9C. Oil and Gas development in Wyoming raises issues associated with the disposal and treatment of the water produced to facilitate production of oil and gas. To help fulfill the objectives of this strategy, and take a proactive approach to address the interdependence of water and energy development, research is needed in the following areas:

- Treatment and use of water produced by industrial and agricultural operations.
- Improved regulatory standards for reuse.
- Investment in reuse technology.
- Incentives for third-party investment.
- Development of industrial uses for produced water.
- Development of advanced water treatment facilities for recovery and reuse.

Ditch/Canal Conveyance Losses

Proper accounting of stored water, natural flows, crop irrigation requirement, and return flows is an important component in the development of hydrologic models in agricultural areas. Both short term and long term conveyance efficiency in ditches and canals are important to understand. 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.

Generally, surface water used for irrigation consists of both natural stream flows and potentially stored water released from upstream reservoirs. Water can be diverted from a stream or river through small ditches and/or large canals. To better develop hydrologic models meant to determine volume, location, and timing of irrigation shortages and available water for development, perhaps in the form of new reservoirs, water developers desire to have a better understanding of conveyance (ditch/canal) efficiencies in various settings. The study objective would be to evaluate conveyance efficiencies of a variety of ditch/canal sizes in a variety of soil conditions, geographic locations, and settings 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.

E. Coli

There are over 70 waterbodies listed on the State's 303(d) list of impaired waters due to elevated E. Coli levels. As a result, millions of dollars are invested in attempting to reduce E. Coli loads to streams from a variety of sources.

(http://www.conservewy.com/Attached%20Files/2011WatershedReport%20video%20files/2011WatershedReportIntroS.pdf). Further research to address the following would be beneficial in addressing the E. Coli issue:

- What are the natural background levels of E. Coli in non- or minimally-anthropogenic influenced watersheds, i.e. where minimal human activity is occurring? This question is posed frequently. The current E. Coli standard was developed by EPA based on surveys on the incidents of human illness in beach type high use recreation areas. There is a need to more accurately determine what background levels can be anticipated in order to determine what, if any, consideration can be given to those contributions in BMP implementation, TMDL development, etc.
- Studies evaluating the fate and transport of E. coli in Wyoming streams. For example, what is the ability of E. coli to persist in the environment (i.e., channel sediments)?
- Studies comparing E. coli levels in streams/rivers to actual pathogen measurements and/or epidemiological studies relating E. coli levels to incidence of water-borne pathogen exposure in streams/rivers. Is E. coli a valid indicator of water-borne pathogens/human-health risk in Wyoming lotic systems? As described above, the national standard was developed based on beach type high use recreation areas, not flowing streams/rivers.

Groundwater Modeling/Aquifer Potential Characterization

Governor Mead's Wyoming Water Strategy (2015), Initiative 3, Groundwater Analysis and Control Area Management Framework", seeks to address the challenges of measuring and allocating groundwater in areas of growing population and declining groundwater resources. Priority is placed on developing "information sharing and management tools" and "innovative management plans" in Groundwater Control Areas in collaboration with the Wyoming State Engineer's Office.

Research regarding the integration of recognized modeling techniques with existing hydrogeologic and geophysical measurements to understand aquifer reservoir properties and dynamics is needed. In portions of basins within Wyoming developed for groundwater demands, uncertainty persists regarding the intrinsic nature of aquifers presently pumped and those with future supply availability opportunities. A wealth of information already exists such as extensive hydro-geologic mapping, surface/remote sensing surveys, geophysical logs of boreholes, pump test data & analysis, historic peizometric data, metered discharge reporting, etc. Priority is given to the application of digital/numeric/statistical tools to explored localities or existing well fields to increase knowledge of key aquifer systems of the State.

In addition to the above priorities, the following are of interest in furthering the goals related to "Leading the Charge: Wyoming Water Strategy"

Surface Water Hydrology: Studies related to the management of surface and connected shallow groundwater formations to better understand, manage, and enhance water availability and uses.

Groundwater Hydrology/Modeling: Studies related to the management of groundwater resources that are hydrologically disconnected from surface waters to better understand, manage, protect, and enhance those resources.

Water Recycling, Reuse, Treatment and Conservation: Studies designed to better understand and manage the quality of surface or groundwater resources for the benefit of humans and other environmental purposes.

Biological Processes: Studies designed to better understand and manage water resources to maintain, restore, or enhance any plant or animal populations or communities that support the State's interests and authority over the management of those organisms.

Irrigation: Studies to identify methods to improve irrigation efficiencies and related water management to maximize the beneficial use of water, including assessing the hydrologic/ecologic effects of change in irrigation methods.

Atmospheric/Hydrologic Processes: Studies to better understand and/or manage atmospheric conditions and processes to maintain or improve hydrologic yields in Wyoming.

Engineering: Studies that identify potential engineering solutions to water quantity and/or quality challenges.

Economics/Social Sciences: Strategies to improve the cost effectiveness of multi-use water development opportunities.

Multiple Resource Management: Studies designed to reveal opportunities to maximize multiple uses of water that enhance economic and non-economic benefits to the State.