

## **Statement of Interest**

**W912HZ-15-SOI-0019**

**Project to be initiated in 2015**

**Project Title: Water Operations Technical Support: Research to Investigate Atmospheric Rivers (AR) and the Feasibility of Developing and Using AR Forecast Capabilities to Inform Reservoir Operations Within the USACE**

Responses to this Request for Statements of Interest will be used to identify potential investigators for a research and development project to be funded by the U.S Army Corps of Engineers (USACE) Engineer and Research and Development Center's Coastal and Hydraulics Laboratory, Vicksburg, MS (ERDC/CHL). This project is expected to last five (5) years. Approximately \$1.25M is expected to be available to support this project in the first year. Funding for future years (4 option periods) may also be available at an estimated amount of \$4.0M/year for an anticipated total of \$17.25M for this project including base and option years.

### **Background:**

Lake Mendocino is located on the East Fork of the Russian River in Mendocino County, California. Created in 1958 by the Coyote Valley Dam, it provides flood control, water supply, recreation and stream flow regulation. The U.S. Army Corps of Engineers (USACE) owns and operates the dam in accordance with the Lake Mendocino Water Control Manual (LMWCM) (1959, revised in 1986). Sonoma County Water Agency is the local partner that manages water stored in Lake Mendocino for water supply.

The LMWCM specifies elevations for an upper volume of reservoir storage that must be kept available for capturing storm runoff and reducing flood risk and a lower volume of storage that may be used for water supply. During a flood event, runoff is captured by the reservoir and released soon after to create storage space for another potential storm. The LMWCM is based on typical historical weather patterns— wet during the winter, dry otherwise.

The LMWCM utilizes gross estimates of flood potential to establish reservoir storage and release requirements. It does not account for changing conditions in the watershed—for example, increased variation in dry and wet weather patterns and reductions to imported flows into the Lake that have occurred since 1986. Also, the LMWCM's reservoir operations procedures were developed decades ago, without the benefit of current science that more accurately predicts weather and stream flow.

Given reduced supplies, changed hydrologic conditions, and technological advances, some adjustments to the current reservoir operating procedures may be possible to optimize the goals of maintaining flood control while bolstering water supply reliability for downstream users and the environment (e.g., to support recovery of endangered and threatened fish). Modern observation and prediction technology could be used to reduce flood risk by supporting decisions of greater reservoir level drawdown in advance of storms. Or, such technology might be used to

improve supply reliability by permitting more storm runoff to be retained for water supply while still preserving flood risk reduction objectives.

For example, following an atmospheric river-type storm in December 2012, water was released to create flood space according to the LMWCM, dropping reservoir levels by more than 35%. 2013 was the driest year on record, resulting in little inflow to refill the reservoir. By December 2013 lake levels were extremely low and remained low through 2014. Ideally, water from the December 2012 event could have been retained based on a longer-term precipitation forecasts, lessening the impact of drought.

### **Brief Description of Research:**

The proposed research effort will consist of a viability study to determine if Forecast-Informed Reservoir Operations (FIRO) at Lake Mendocino can improve water supply, maintain flood risk reduction, and achieve additional ecosystem benefits. Recent studies show the potential for improved predictability of atmospheric rivers, which provide 50% of the region's precipitation and cause most of the Russian River's floods.

FIRO is a management strategy that uses data from watershed monitoring and modern weather and water forecasting to help water managers selectively retain or release water from reservoirs in a manner that reflects current and forecasted conditions. FIRO's utilization of modern technology can optimize the use of limited resources and represents a viable climate change adaptation strategy.

ERDC and the USACE have extensive capabilities in meteorological, hydrologic and hydraulic science and modeling that will be necessary to the success of this project. However, the USACE lacks expertise and understanding of the factors affecting successful identification and prediction of the phenomenon known as Atmospheric Rivers (AR). Therefore, a collaborative research partner is sought to engage with ERDC and the USACE to conduct this research project. A strong collaboration between ERDC-CHL and the proposers is desired.

### **Objectives:**

The goal of FIRO is to develop tools and capabilities to enhance standard flood control guidelines in order to improve water supply and environmental outcomes without diminishing flood risk reduction or dam safety, thereby providing significant benefit to the public. It is anticipated that FIRO-developed capabilities would not only be of benefit to operations at Lake Mendocino, but also have transferability potential throughout the western U.S. The project has two main objectives:

*Improve Supply Reliability for Downstream Uses* - When storms cause moderate-to-high reservoir levels, normal operation is to release water to re-establish flood control space. With FIRO, some of that water could be retained for future supply as long as no major precipitation is predicted for several days and it can be demonstrated that the retained water can be released past downstream flood prone areas before the arrival of the next storm. This strategy will permit earlier supply capture in some years, improving summer season supply reliability for

downstream water users and improving the timing and volume of releases to protect water quality and provide flows needed for recovery of fish populations.

*Enhance Flood Risk Reduction* - When a storm is predicted to cause flooding, normal operations call for release of reservoir water and drawdown of water levels. With FIRO, release decisions would consider weather observations and predictions, which, in some cases, would indicate greater drawdown for flood risk reduction so long as there is confidence that the amount of precipitation and runoff will restore reservoir levels for water supply after the storm.

The project will include:

- Develop evaluation criteria at western USACE reservoirs for:
  - Flood control
  - Water supply
  - Environmental flows
- Evaluate current Coyote Dam (Lake Mendocino) performance
- Define evaluation methodology and model development paths
- Create evaluation scenarios for Coyote Dam operations
  - Baseline scenario (past performance)
  - Drought scenarios
  - Flood scenarios
- Evaluate model results
- Evaluate FIRO viability
- Assess benefits
- Recommend future actions
  - Further testing
  - Staged implementation
  - Accelerated forecast system
  - Decision support tool development

#### **Tasks by Year:**

##### **Base Year**

- Requirements development
  - Weather & stream flow forecast lead times & accuracy
  - Evaluation criteria for atmospheric river and extreme precipitation predictions
- Evaluation of past performance
  - Hydrologic
  - Reservoir operations
  - Weather
- Project planning & coordination

##### **Option Year 1**

- Weather research & forecast model development
- Hydrologic runoff model development
- Begin development of interface between weather & hydrology models
- Begin development of coupling between new and existing models for Russian River

### **Option Year 2**

- Continued development and testing of weather research & forecast model
- Continued development and testing of hydrologic runoff model
- Continued development and testing of interface and coupling between weather & hydrology models and with existing water operations framework

### **Option Year 3**

- New technologies demonstration
  - Flood control benefits
  - Water supply benefits
  - Environmental flow benefits
- Testing and demonstration of FIRO in Lake Mendocino scenarios, in parallel with actual operations conditions

### **Option Year 4**

- Quantify FIRO impacts
  - Flood control perspective
  - Water supply perspective
  - Cost-benefit perspective
- Develop technical recommendations
  - Publish findings
  - Collect stakeholder comment

### **Requirements:**

Successful applicants should have expert knowledge and experience investigating and predicting atmospheric rivers and their impact to watersheds along the west coast of the United States. They should also have technical expertise in the fields of data evaluation, QA/QC, statistical analysis, higher order analysis skills, data archiving systems and dissemination of the data to the public in usable form.

### **Government Furnished Property and Services:**

The Government will collaborate with the investigator to research the phenomenon of atmospheric rivers and the feasibility of using state-of-the-art forecast information to inform reservoir operations in the USACE. The Government will also collaborate with the investigator to identify and develop appropriate predictive atmospheric, hydrologic and hydraulic tools required for successful FIRO execution.

### **Materials Requested for Statement of Interest/Qualifications:**

Please provide the following via e-mail to:

Robyn.D.Wells@usace.army.mil (maximum length 2 pages, single spaced 12 pt. font)

- 1) Name, Organization and Contact Information
- 2) Brief Statement of Qualifications including:
  - a. Biographical Sketch

- b. Relevant past projects and clients with brief description of project
- c. Staff, faculty and students available including area of expertise
- d. Brief description of capabilities to successfully complete this project

Note: a proposed budget is NOT requested at this time.

**Review of Statements Received:** Based on a review of the Statements of Interest received, an investigator or investigators will be invited to prepare a full study proposal. Statements of Interest will be evaluated based on investigators specific experience and capabilities in areas related to the study requirements. Additionally, the evaluation method and selection criteria for research and development awards must be: 1) The technical merits of the proposed research and development; and 2) Potential relationship of the proposed research and development to the USACE missions.

**Please send responses or direct questions to:**

Robyn D. Wells  
CEERD-CT-V  
U.S. Army Engineer Research and Development Center (ERDC)  
ERDC Contracting Office (ECO)  
3909 Halls Ferry Rd.  
Vicksburg, MS 39180  
Robyn.D.Wells@usace.army.mil

**Timeline for Review of Statements of Interest:** Review of Statements of Interest will begin after the SOI has been posted on the CESU website for 10 working days.