**REQUESTS FOR STATEMENTS OF INTEREST**

**NUMBER W81EWF-20-SOI-0002**

**PROJECT TO BE INITIATED IN 2020**

**Project Title: Assessing Water Quality Trends and Suspended Sediment Surrogates Above and Below Reservoirs Using High-Frequency Sensors in New Mexico and Southern Colorado**

Responses to this Request for Statements of Interest will be used to identify potential investigators for a project to be funded by the U.S. Army Corps of Engineers (USACE) Albuquerque District (SPA), in Albuquerque, NM. Approximately $200,000 is expected to be available to support this project for one (1) year. Additional funding maybe available at a rate of $205,000/year for up to 4 additional option years based on future R&D needs for a total of $1,020,000 for the full project.

**Background:**

USACE water resources projects store, regulate, divert, constrict, or convey surface water throughout the United States. As water moves through these projects, the physical, chemical, and biological components of water quality are altered (USACE 2018). A better understanding of these processes and interactions provides USACE the opportunity to plan, operate, maintain, and modify projects in ways that provide for sustainable human uses while protecting, restoring, and conserving the ecological sustainability of the water resources where permissible or required by law (USACE 2018). A water quality monitoring and evaluation program ensures that achievement of water quality management objectives, the evaluation of project performance, and understanding of water quality and associated trends is recommended (USACE 2018). However, these programs typically consist of discrete grab samples that are analyzed for chemical and physical constituents, which do not capture the temporal variability and integrate ecosystem processes (Krause et al. 2015, USACE 2018). The establishment of long-term and high-frequency water quality monitoring networks provide the temporal and spatial resolution to better understand the linkages between catchment hydrology, water chemistry, suspended sediment, and aquatic ecosystem processes (Johnson et al. 2007, Rasmussen et al. 2009, Krause et al. 2015, Bernhardt et al. 2018).

Within SPA, long-term and high-frequency monitoring of five water quality parameters (temperature, dissolved oxygen, specific conductance, turbidity, and pH) in the Rio Grande basin has occurred since 2006 (Van Horn et al, 2018 and references therein). These data and subsequent analyses have documented considerable spatially and temporally variability, longitudinal gradients, influence of reservoirs, inter-annual hydrologic variation, and influence of disturbances on water quality and in-stream ecosystem processes (Dahm et al. 2013, Reale 2014, Dahm et al. 2015, Reale et al. 2015, Shafer et al. 2019, Shafer et al. 2019, Van Horn et al. In review, Reale et al. Resubmitted, Regier et al. Submitted). These findings necessitate the continuation of monitoring and research within the Rio Grande basin and expanding these efforts to other basins that include water resources projects managed by SPA.

**Objectives:**

There are five main objectives to this SOI:

1. Collect, review, and disseminate real-time and high-frequency water quality data upstream and downstream of SPA reservoirs.
2. Assess episodic, seasonal, and interannual trends in water quality and in-stream ecosystem processes and the influence of SPA reservoirs on the observed variability.
3. Evaluate the influence of SPA reservoirs on water quality conditions and in-stream ecosystem processes that can be linked to natural and anthropogenic disturbances.
4. Determine the suitability of using turbidity and streamflow records to calculate high-frequency suspended sediment concentrations and loads upstream and downstream of SPA reservoirs.
5. Prepare scientific professional and technical reports for publication in peer reviewed journals.

**Brief Description of Anticipated Work:**

The Vendor and SPA will identify, establish and/or maintain eleven (11) real-time, long-term, and high-frequency water quality monitoring stations above and below SPA-managed reservoirs (Table 1) to achieve **Objective 1**. At each station, five water quality parameters (i.e., temperature, conductivity, dissolved oxygen, pH and turbidity) will be collected using multi-parameter sensors (sonde). Photosynthetic photon flux density will be collected at one station per reservoir and will be used as an input for a whole-stream metabolism modelling. Sensor maintenance will occur at 4-6 week intervals following current USGS operating procedures (Wagner et al. 2006). All time-series records collected will be validated following USGS procedures (Wagner et al. 2006) using Aquarius Workstation (Aquatic Informatics, Vancouver, Canada).The Vendor and SPA will install and or maintain real-time data acquisition and photovoltaic power system at each site. The Vendor will maintain the communication and retrieval between all deployed sensors, dataloggers, computers, and servers were data will be stored. The Vendor will provide access to the data server to allow for fetching and transmission onto SPA’s website (i.e., <https://www.spa.usace.army.mil/Missions/Civil-Works/Water-Control/>) for dissemination to the general public and water managers via the internet.

Findings from this project should demonstrate the importance of continued high-frequency sampling to further elucidate how riverine water quality and in-stream ecosystem processes (e.g., whole-stream metabolism) are affected by climatic and hydrologic variability, the role/function of SPA-reservoirs, impacts of watershed-scale disturbances (e.g., drought, flood, wildfire), point-source and non-point-source pollution, and alteration of the natural flow regime (**Objectives 2 and 3)**. The Vendor will propose specific research topics that incorporate sonde data collected under this project, in addition to other readily available data sets, to address these objectives and also of interest to the greater scientific community.

While collecting accurate and reliable suspended sediment data is critical to water resources planning, reservoir management, and research, the cost of installing, operating and maintaining the suspended sediment gages has caused a decline in the existing network. The use of in-stream turbidity and streamflow data to compute time-series suspended sediment concentrations and loads may reduce the cost of continuous suspended sediment monitoring compared to current methods (Rasmussen et al. 2009). However, this method has been evaluated in predominantly in mesic streams and rivers outside of the southwestern region (but see Brown 2014). The Vendor and SPA will determine the suitability of this method in large arid rivers above and below SPA-managed reservoirs (**Objective 4**). To support this investigation, discrete samples will be collected during each site visit and analyzed by the Vendor for total suspended sediments during each site visit following standard methods (Edwards et al. 1999, Davis 2005, Groten and Johnson 2018). All suspended data will be maintained in Aquarius Samples (Aquatic Informatics, Vancouver, British Columbia, Canada), a cloud-based data management system funded separately by SPA.

The major research findings will be documented in technical reports drafted by the Vendor and SPA for publication in peer reviewed journals (**Objective 5**). The Vendor will be responsible for all associated publishing fees. The Vendor and SPA will also generate quarterly reports outlining significant findings, progress, and limitations during the quarter. Annual reports using internally and externally-collected water quality and quantity data throughout the year above, within, and below each SPA-managed reservoir, will be authored by the Vendor and SPA.

**Supplies and Materials**

SPA will provide equipment and materials for water quality data collection in Appendix A. The Vender is responsible for acquiring all remaining supplies and material to successfully complete the project.

**Public Benefit:**

The data, reports, and publications generated under this project will benefit the public through increased awareness and understanding of the water quality conditions, links between water quality and biota, and stream ecosystem processes within multiple watersheds. Data collected for this project will also support the work of numerous local, state, and federal agencies responsible for assessing and managing water and natural resources within these basins. Collecting and analyzing these data will benefit the aquatic ecosystems by furthering the understanding of how reservoirs influence physical, chemical, and biological components of water quality. Evaluating the use of turbidity and streamflow records to calculate high-frequency suspended sediment concentrations and loads in arid rivers may reduce the cost of continuous suspended sediment monitoring compared to current methods.

**Site Locations:**

* Arkansas River above and below John Martin Reservoir, CO
* Purgatorie River above and below Trinidad Reservoir, CO
* Canadian River above Conchas Reservoir, NM
* Pecos River above and below Santa Rosa Reservoir, NM
* Rio Chama above and below Abiquiu Reservoir, NM
* Rio Grande above Cochiti Lake, NM\*
* Rio Grande downstream of confluence with Rio Jemez, NM\*

Table 1 New and existing (\*) long-term and high-frequency water quality monitoring stations to be operated and maintained during Year 1 of the SOI.

**Vendor Requirements:**

Vendor must be a non-federal partner of the Colorado Plateau CESU Unit willing to accept the negotiated CESU indirect cost rate of 17.5%. Applicants should have expert knowledge and work experience in selecting, installing, operating, maintaining, and overseeing multi-year and continuously deployed (e.g., year-round or during ice-free periods) high-frequency water quality sensor (i.e., temperature, conductivity, DO, pH, and turbidity) networks in large rivers, preferably in systems with high suspended sediment loads within the southwestern U.S. Previous experience evaluating discrete water quality and suspended sediment data with high-frequency water quality and streamflow data is preferred. The candidates should have experience reviewing and approving data from water quality sensor networks using Aquarius Time-Series (or equivalent software). The candidates should have experience publishing in peer reviewed journals assessing water quality using data from long-term and continuously deployed high-frequency water quality sensor networks, preferably in large rivers within the southwestern U.S.

**Government Participation:**

50% of the station operation and maintenance will be provided by SPA staff. SPA will lead the effort to obtain Right of Entry and ensure NEPA is conducted, with support from the Vendor. SPA will contribute towards all complex and extensive tasks (e.g., station installation/relocation, telemetry installation, annual mass calibration, data analysis, and drafting reports and manuscripts, etc.).

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

Please provide the following via e-mail attachment to: Deberay.R.Carmichael@usace.army.mil Maximum length: 2 pages, single-spaced 12 pt. font).

1. Name, Organization and Contact Information
2. Brief Statement of Qualifications (including):
	1. Biographical Sketch,
	2. Relevant past projects and clients with brief descriptions of these projects,
	3. Staff, faculty or students available to work on this project and their areas of expertise,
	4. Any brief description of capabilities to successfully complete the project you may wish to add (e.g. equipment, laboratory facilities, greenhouse facilities, field facilities, etc.).

**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 will be evaluated based on the investigator’s 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 Department of Defense missions.

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

Deberay R. Carmichael

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**Availability of Opportunity:**

Statements of Interest must be received by December 17, 2019 to be eligible for consideration.

**References**

Bernhardt, E. S., Heffernan, J. B., Grimm, N. B., Stanley, E. H., Harvey, J., Arroita, M., Appling, A., Cohen, M., McDowell, W. H., and Hall, R. 2018. The metabolic regimes of flowing waters. Limnology and Oceanography 63:S99-S118.

Brown, J. E. 2014. Estimation of Suspended-sediment Concentration Using Instream Turbidity as a Surrogate in the Middle Rio Grande, New Mexico.

Dahm, C. N., Candelaria-Ley, R., Reale, C. S., Reale, J. K., and Van Horn, D. J. 2015. Extreme water quality degradation following a catastrophic forest fire. Freshwater Biology.

Dahm, C. N., Van Horn, D. J., Reale, J. K., Candelaria-Ley, R., and Reale, C. S. 2013. Continuous water quality monitoring of the Rio Grande and Rio Chama. University of New Mexico, Submitted to the U.S. Army Corps of Engineers, Albuquerque, NM.

Davis, B. E. 2005. A guide to the proper selection and use of federally approved sediment and water-quality samplers. US Geological Society.

Edwards, T. K., Glysson, G. D., Guy, H. P., and Norman, V. W. 1999. Field methods for measurement of fluvial sediment. US Geological Survey Denver, CO.

Groten, J. T., and Johnson, G. D. 2018. Comparability of river suspended-sediment sampling and laboratory analysis methods. US Geological Survey.

Johnson, K. S., Needoba, J. A., Riser, S. C., and Showers, W. J. 2007. Chemical sensor networks for the aquatic environment. Chemical Reviews 107:623-640.

Krause, S., Lewandowski, J., Dahm, C. N., and Tockner, K. 2015. Frontiers in real‐time ecohydrology–a paradigm shift in understanding complex environmental systems. Ecohydrology.

Rasmussen, P. P., Gray, J. R., Glysson, G. D., and Ziegler, A. C. 2009. Guidelines and procedures for computing time-series suspended-sediment concentrations and loads from in-stream turbidity-sensor and streamflow data. US geological survey techniques and methods, book 3:52.

Reale, J. K. 2014. Water temperature monitoirng on the Rio Grande during the 2014 snowmelt Funded by the Middle Rio Grande Endangered Species Collaborative Program, U.S. Army Corps of Engineers, Albuqueque District.

Reale, J. K., Archdeacon, T. P., Horn, D. J. V., Gonzales, E. J., Dudley, R. K., Turner, T. F., and Dahm, C. N. Resubmitted. Effects of a catastrophic wildfire on downstream fish assemblages in an aridland river. Hydrobiologia.

Reale, J. K., Van Horn, D. J., Condon, K. E., and Dahm, C. N. 2015. The effects of catastrophic wildfire on water quality along a river continuum. Freshwater Science 34:1426-1442.

Regier, P., Gonzalez-Pinzón, R., Reale, J. K., Van Horn, D. J., Khandelwal, A., and Nichols, J. Submitted. Impacts of urban stormwater runoff on downstream water quality in the Rio Grande. Science of the Total Environment.

Shafer, B., Van Horn, D. J., Reale, J. K., Gonzalez-Pinzón, R., Bixby, R., and Stone, M. C. 2019. The impacts of large-scale climate patterns and localized disturbance events on whole stream metabolism in an aridland river. Department of Biology. University of New Mexico, Albuquerque, NM.

Shafer, B., Van Horn, D. J., Reale, J. K., Gonzalez-Pinzón, R., Bixby, R., and Stone, M. C. 2019. Seasonal and interannual variability in stream metabolism along an aridland river. Department of Biology. University of New Mexico, Albuquerque, NM.

USACE 2018. Water quality management. Engineering Regulation 1110-2-8154. Washington, DC.

Van Horn, D. V., Reale, J. K., and Archdeacon, T. P. In review. Water quality in three potential refugia in an arid-land river: assessing suitability to sustain fish populations Aquatic Sciences.

Van Horn, D. V., Reale, J. K., and Segura, M. V. 2018. Assessing temporal and spatial continuous water quality trends in the Upper Rio Grande, Rio Chama, and Middle Rio Grande (Water Year 2017). Biology Department, University of New Mexico. Prepared for U.S. Army Corps of Engineers, Albuquerque District.

Wagner, R. J., Mattraw, H. C., Ritz, G. F., and Smith, B. A. 2006. Guidelines and standard procedures for continuous water-quality monitors: Site selection, field operation, calibration, record computation, and reporting. US Department of the Interior, US Geological Survey Techniques and Methods 1–D3, 51 p. + 8 attachments.

**APPENDIX A: Government Furnished Equipment**

* 1. **Equipment**: The Government will provide the following new and used items in support of this project. Quantities are in parentheses.
		1. **New Equipment:**
* YSI EXO III multi-parameter sonde bodies (12).
* YSI EXO optical DO sensors (12).
* YSI EXO turbidity sensors (12).
* YSI EXO wiped conductivity and temperature sensor (14).
* YSI EXO ungarded pH sensors (12).
* YSI EXO central wipers (12).
* 15-meter YSI EXO compatible flying lead cables (6).
* 20-meter YSI EXO compatible flying lead cables (6).
* YSI EXO unguarded pH probe replacement modules (12).
* 10-amp 12-Volt solar charge controllers with low voltage disconnect, series regulation, and series configuration (12).
* Campbell Scientific CR-300 with integrated CELL210 w/4G LTE CAT1 modem (12).
* Coaxial antenna cables (12).
* 2 dBd 4G/3G multi-band omnidirectional antennas with mounting hardware.
* Surge protection kits (12).
* 20-Watt solar panels with 15-foot tinned terminals and mounting kit for a mast (11).
* Null modem cables: 9-pin male to 9-pin male connects to RS-232 ports (12).

**Used Equipment:** All used equipment was deemed functional as of advertisement. Quantities are in parentheses.

* YSI EXO II multi-parameter sondes (2).
* YSI EXO III multi-parameter sonde (1).
* YSI EXO optical DO sensors (3).
* YSI EXO turbidity sensors (3).
* YSI EXO un-wiped conductivity and temperature sensor (2).
* YSI EXO wiped conductivity and temperature sensor (1).
* YSI EXO ungarded pH sensors (3).
* YSI EXO central wipers (3).
* 20 Watt solar panels with 15-foot tinned terminals and mounting kit for a mast (1).