REQUEST FOR PROPOSALS (RFP)

Optimizing Sensor Networks and Advanced Sensing Techniques for Enhanced Collection Systems Management (RFP 5239)

Date Posted
Monday, July 1, 2024

Due Date
Proposals must be received by 3:00 pm Mountain Time on Thursday August 29, 2024.

WRF Project Contact
Harry Zhang, PhD, PE, hzhang@waterrf.org

Project Sponsors
This project is funded by The Water Research Foundation (WRF) as part of WRF's Research Priority Program.

Project Objectives
- To advance the optimization of the layout of sensor networks and sensing techniques in collection systems to enhance One Water management.
- To improve data analytics, forecasting, modeling, and intelligent platform/dashboard environments to help with operations for a range of flow conditions and control schemes, preventive and in-time maintenance of collection systems, and optimization of capital improvement programs.

Budget
Applicants may request up to $150,000 in WRF funds for this project.

Background and Project Rationale
In the context of One Water management, collection systems management includes the following components: (1) real-time flow control for maximizing the system hydraulic performance; (2) in-time maintenance to prevent avoidable operational issues; and (3) optimized preventive maintenance, addition of new assets, and capital improvements; (4) water recycling and reuse needs; (5) epidemiology related studies. Taking a broad view, the sensor network for collection and conveyance systems can be a combination of rain gauges, as well as water depth, flow, and pressure sensors for the sewer network within a utility's boundary and related storage infrastructure. Collection system operators are increasingly challenged by extreme weather events, climate impacts, and regulatory water quality

compliance needs, which are exacerbated by the growing inability of aging infrastructure to manage flows beyond design capacity.

Collection system operators need improved management tools to manage a widening range of flow conditions and to optimize flow capture and discharge, using strategically spaced sensors integrated with software to enable a smart system. They are interested in developing smarter collection systems with analytical tools to enhance the use of available system capacity and optimize planning of system improvements, including integration of predictive forecasting into the systems controls for proactive decision-making. Furthermore, collection system operators are increasingly looking for data-driven systems to deliver in-time maintenance to avoid undesirable sewer back-ups and overflows and exceedance of water quality standards, including under a changing climate. Operators also need improved predictive tools for programming preventive maintenance, adding new assets, and making capital improvements.

This project will advance the optimization of the sensor network (including placement and control schemes) and sensing techniques in collection systems. Furthermore, it will improve data analytics, forecasting and modeling, and intelligent platform/dashboard environments to help with operations for a widening range of flow conditions (control schemes), preventive and in-time maintenance of the collection system, and optimization of capital improvement programs.

Research Approach

The research team will conduct a comprehensive literature review, including WRF's research efforts to date (please see "References and Resources" section). The project will build from completed and ongoing efforts by focusing on four types of municipal practices and case studies: (a) sensor network design/optimization; (b) application of water quality sensors, advanced data analytics (including forecasting techniques and modeling tools), and intelligent platforms/dashboards; (c) real-time flow control schemes and technologies; and (d) physical assessments of operational assets at water resource recovery facilities (WRRFs), site-specific assets in the collection system such as remote pumping stations, valves and gates, and the collection system itself, such as pipe conditions. When applicable, all applications researched should also consider or include an artificial intelligence (AI) component. This would help inform a wide range of collection system operators and managers as technology advances.

The research team will conduct a survey and targeted interviews with selected utilities and municipalities that cover wastewater and stormwater issues, with a goal of synthesizing real-world practices and case studies across geographic regions and different sizes of utilities.

In addition, a utility-focused invitation-only virtual workshop (e.g., in two 3-hour sessions) will be held with multiple utilities and municipalities across geographic regions that are facing similar challenges. The objectives of this utility workshop are to share what has or hasn't worked in the past, discuss pros and cons of different approaches, and identify future research needs. The virtual workshop invitees will also include Project Advisory Committee (PAC) members (i.e., a technical review committee managed by WRF), representatives from

participating utilities, WRF's collaborators and partners, and other invitees recommended by WRF.

The research team will develop a utility-facing "state-of-the-practice" guidance document, which includes a synthesis of case studies across different geographic regions and utility sizes, with a focus on utilities and municipalities in North America. The guidance document will also include a specific chapter on emerging technology development for sensor networks and advanced sensing techniques (including from beyond the water sector), and applications supported by artificial intelligence/machine learning (AI/ML). In addition, a separate chapter in the guidance document will summarize the knowledge gaps, research needs, and preliminary project concepts for recommended future research projects.

The research team will conduct one webcast hosted by WRF and collaborating organizations on the overall findings of this project. The research team is also encouraged to submit one open access peer-reviewed journal paper, after the completion of the project. In addition, the research team should consider additional outreach activities, such as presenting project findings at conferences.

Expected Deliverables
- A stand-alone literature review, including annotations for the list of publications and resources used.
- A user-friendly utility-facing guidance document that includes decision tree logic and optimization methodologies, and a synthesis of utility case studies.
  - The guidance document should include a specific chapter on emerging technology development for sensor networks and advanced sensing techniques, applications supported by AI/ML.
  - The guidance document should include a specific chapter and supporting technical appendix that summarize the knowledge gaps, research needs, and preliminary project concepts for recommended future research projects, including recommended means to address those remaining gaps.
- A utility-focused invitation-only virtual workshop (with two sessions) for peer-to-peer information exchange and identification of future research needs, along with workshop planning and all supporting materials (e.g., agenda, presentations, meeting notes, and workshop summary).
- Broader outreach:
  - Webcast and public outreach materials.
  - Conference presentation included at a WEF-sponsored conference.
  - Submitting one open access peer-reviewed journal paper is encouraged and can be completed beyond project end date, if the research team would like to submit.

Communication Plan
Please review WRF's *Project Deliverable Guidelines* for information on preparing a communication plan. Conference presentations, webcasts, peer-reviewed publication submissions, and other forms of project information dissemination are typically encouraged.

Project Duration

The anticipated period of performance for this project is 21 months from the contract start date. The submission of one open access peer-reviewed journal paper can go beyond the project end date.

References and Resources

The following list includes examples of research reports, tools, and other resources that may be helpful to proposers. It is not intended to be comprehensive, nor is it a required list for consideration.

Liggett, J., C. Macintosh, and K. Thompson. 2018. *Designing Sensor Networks and Locations on an Urban Sewershed Scale (Phase I)*. Project 4835. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/projects/designing-sensor-networks-and-locations-urban-sewershed-scale-phase-i

Salveson, A. 2023. *Integrating Real-Time Collection System Monitoring Approaches into Enhanced Source Control Programs for Potable Reuse.* Project 5048. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/projects/integrating-real-time-collection-system-monitoring-approaches-enhanced-source

Thompson, K., S. Sinha, R. Dadiala, A. Vishwakarma, and C. Dermody. Forthcoming. *Designing Sensor Networks and Locations on an Urban Sewershed Scale with Big Data Management and Analytics.* Project 4797. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/projects/designing-sensor-networks-and-locations-urban-sewershed-scale-big-data-management

Proposal Evaluation Criteria

The following criteria will be used to evaluate proposals:

- Understanding the Problem and Responsiveness to RFP (maximum 20 points)
- Technical and Scientific Merit (maximum 30 points)
- Qualifications, Capabilities, and Management (maximum 15 points)
- Communication Plan, Deliverables, and Applicability (maximum 20 points)
- Budget and Schedule (maximum 15 points)

PROPOSAL PREPARATION INSTRUCTIONS

Proposals submitted in response to this RFP must be prepared in accordance with WRF's *Guidelines for Research Priority Program Proposals* and *Instructions for Budget Preparation*. These guidelines contain instructions for the technical aspects, financial statements, indirect costs, and administrative requirements that the applicant must follow when preparing a proposal.

Proposals that include the production of web- or software-based deliverables, such as websites, Excel spreadsheets, Access databases, etc., must follow the criteria outlined for technology deliverables presented in the *Technology Deliverables Guidance*.

Eligibility to Submit Proposals
Proposals will be accepted from both U.S.-based and non-U.S.-based entities, including educational institutions, research organizations, governmental agencies, and consultants or other for-profit entities.

WRF's Board of Directors has established a *Timeliness Policy* that addresses researcher adherence to the project schedule. Researchers who are late on any ongoing WRF-sponsored studies without approved no-cost extensions are not eligible to be named participants in any proposals. Direct any questions about eligibility to the WRF project contact listed at the top of this RFP.

Administrative, Cost, and Audit Standards
WRF's research program standards for administrative, cost, and audit compliance are based upon, and comply with, Office of Management and Budget (OMB) Uniform Grants Guidance (UGG), 2 CFR Part 200 Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, and 48 CFR 31.2 Contracts with Commercial Organizations. These standards are referenced in WRF's *Guidelines for Research Priority Program Proposals* and include specific guidelines outlining the requirements for indirect cost negotiation agreements, financial statements, and the Statement of Direct Labor, Fringe Benefits, and General Overhead. Inclusion of indirect costs must be substantiated by a negotiated agreement or appropriate Statement of Direct Labor, Fringe Benefits, and General Overhead. Well in advance of preparing the proposal, your research and financial staff should review the detailed instructions included in WRF's *Guidelines for Research Priority Program Proposals* and consult the *Instructions for Budget Preparation.*

Budget and Funding Information
The maximum funding available from WRF for this project is $150,000. The applicant must contribute additional resources equivalent to at least 33% of the project award. For example, if an applicant requests $100,000 from WRF, an additional $33,000 or more must be contributed by the applicant. Acceptable forms of applicant contribution include cost share, applicant in-kind, or third-party in-kind that comply with 2 CFR Part 200.306 cost sharing or matching. The applicant may elect to contribute more than 33% to the project, but the maximum WRF funding

available remains fixed at $150,000. Proposals that do not meet the minimum 33% of the project award will not be accepted. Consult the *Instructions for Budget Preparation* for more information and definitions of terms.

Period of Performance
It is WRF's policy to negotiate a reasonable schedule for each research project. Once this schedule is established, WRF and its sub-recipients have a contractual obligation to adhere to the agreed-upon schedule. Under WRF's *No-Cost Extension Policy*, a project schedule cannot be extended more than nine months beyond the original contracted schedule, regardless of the number of extensions granted.

Utility and Organization Participation
WRF encourages participation from water utilities and other organizations in WRF research. Participation can occur in a variety of ways, including direct participation, in-kind contributions, or in-kind services. To facilitate their participation, WRF has provided contact information, on the last page of this RFP, of utilities and other organizations that have indicated an interest in this research. Proposers are responsible for negotiating utility and organization participation in their particular proposals. The listed utilities and organizations are under no obligation to participate, and the proposer is not obligated to include them in their particular proposal.

Application Procedure and Deadline
Proposals are accepted exclusively online in PDF format, and they must be fully submitted before 3:00 pm Mountain Time on Thursday August 29, 2024.

The online proposal system allows submission of your documents until the date and time stated in this RFP. To avoid the risk of the system closing before you press the submit button, do not wait until the last minute to complete your submission. Submit your proposal at https://forms.waterrf.org/cbruck/rfp-5239 .

Questions to clarify the intent of this RFP and WRF's administrative, cost, and financial requirements may be addressed to the WRF project contact, Harry Zhang, PhD, PE; 571.384.2098 or hzhang@waterrf.org. Questions related to proposal submittal through the online system may be addressed to Caroline Bruck at 303.347.6118 or cbruck@waterrf.org.

Utility and Organization Participants

The following utilities have indicated interest in possible participation in this research. This information is updated within 24 business hours after a utility or an interested organization submits a volunteer form, and this RFP will be re-posted with the new information. **(Depending on your settings, you may need to click refresh on your browser to load the latest file.)**

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