REQUEST FOR PROPOSALS (RFP)

Phase II Demonstration: Designing Sensor Networks and Locations on an Urban Sewershed Scale With Big Data Management (RFP 4797)

Due: Proposals must be received by 2:00 pm Mountain Time on Monday, March 30, 2020

WRF Project Contact: Walter Graf, wgraf@waterrf.org

Project Sponsors
This project is co-funded by The Water Research Foundation (WRF) and Metro Vancouver as part of the Foundation’s Research Priority Program.

Project Objective
• Consolidate the results of the two Phase I projects (Leveraging Other Industries – Big Data Management (SENG7R16/4836) and Designing Sensor Networks and Locations on an Urban Sewershed Scale (SENG6R16/4835) into a combined demonstration project.
• Conduct demonstration projects at multiple utilities to assess the effectiveness of sensor-based, real-time monitoring/metering and models/decision support systems on sewershed/sub-sewershed scales, including the application of analytics to solve sewershed network management issues.
• As a major funder of this work, Metro Vancouver must be included in any proposal. Please refer to Research approach for additional information.
• Create methodologies and frameworks to assist with the development of sensor-based networks and data management systems that incorporate new and emerging monitoring/metering/analysis technologies which can be used to assess historical data and provide support for real-time decision making.
• Document and summarize lessons learned during this project to assist other utilities in the future.

Budget
Proposals may request up to $340,000 in WRF funds for this project. This will be a single award to the most qualified proposal. As noted above, proposers must include the elements included in Source/Type 2 and 3 at a minimum, with projects associated with other topics included as budget, scope, and schedule permit. A minimum of three demonstrations are required, including Metro Vancouver. The project is envisioned to last 18 to 24 months. WRF funds requested and total project value will be a criteria considered in the proposal selection process.
**Background and Project Rationale**

Many utilities, around the country and internationally, are faced with water quality/quantity challenges related to collection system management. These challenges are primarily related to the control of industrial/commercial wastewater inflows and wet weather flows which affect the viability of treatment/water reuse operations and the frequency/pollutant loading from system overflows. With the recent emergence of low-cost, reliable water quality/quantity sensors and the exponential increases in computing power, the promise of real-time operation of collection systems to address these challenges is being realized. Utilities must comply with water quality control and overflow reduction requirements, and sensor-based networks on a sewershed scale can be used for real-time operational decision making to optimize collection system performance, which could potentially defer investing in major capital-intensive projects.

The Internet of Everything (IoT) is growing at a remarkable speed with an estimated 50 billion connected objects by 2020 (CISCO). What this will mean to the water industry is that there will be massive new datasets available, which when properly analyzed, will create new knowledge that can be used to increase operational efficiency, improve regulatory compliance, and reduce impacts to the water environment.

A large portion of the new data sets will be from a new breed of sensing technology that can perform edge processing using battery power and wireless communications. The traditional methods that utilities use for processing data will not work. In fact, utilities traditionally only thoroughly analyze, on average, about 10% of the data they currently collect (2015 CIO Forum). These new large data streams will require big data analytic engines to process the data into actionable information, which can then be integrated into visualization tools to allow end users to rapidly create knowledge that can be acted upon.

The impact of big data is already being encountered by many utilities that are struggling to obtain maximum value for their investment. The time has come for a paradigm shift in the approach to data management which will open up many areas to improve how the industry does business today. This change is anticipated to truly be a disruptive innovation that will provide significant benefits for the future.

Results collected via industry and non-industry surveys and an expert workshop during Phase I will be consolidated during Phase II. This information will be used to conduct demonstration projects to validate sensor-based, real-time monitoring/metering and models/decision support systems on sewershed/sub-sewershed scales, including the applying analytics to solve sewershed network management issues. Additionally, this information will be used to develop a framework for the development of sensor-based networks that incorporate new and emerging monitoring/metering technologies for real-time decision making and for water quality monitoring and post construction monitoring uses.

The objectives of this two-phase project are summarized below and illustrated in Figure 1.

- What are the key issues and questions that data can help to solve and are they common across utilities?
- How should utilities collect the data and which parameters are required?
- What tools could be used to analyze and manage the data?
- What visualization tools can be developed to help turn data into actionable information?
- What methods and frameworks can be developed to assist utilities now and in the future?
**Research Approach**

Phase II of the project is intended to focus on developing frameworks, methodologies, and guidelines based on the results of demonstration projects that expand on the needs identified in the two Phase I studies, as well as other items identified by the user group panel. These projects could be related to the design and implementation of sewershed monitoring networks, the development of tools to analyze data from the networks, and/or the management of data from those networks. The reports from Phase I studies are essential to this RFP. They contain background information that is summarized below, however, proposers should download these reports to have a full understanding of this solicitation. Download *Designing Sensor Networks and Locations on an Urban Sewershed Scale* report [here](#). The report, *Leveraging Other Industries: Big Data Management* can be downloaded [here](#).

A minimum of three demonstration sites are required, including Metro Vancouver. The three primary sources/types of demonstration projects envisioned for the Phase II work are summarized herein, with additional details provide below:

1. Specific applications and/or knowledge gaps identified in the Phase I reports.
3. Data Use Mapping and Database Management.
Source/Type 1: Specific Items Identified in Phase I Studies

Proposers are invited to propose specific projects that would satisfy the objectives of the study. However, it is not an exhaustive list, and the attractiveness of an Intelligent Water System (IWS) lies in imaginative and innovative solutions. A few examples of specific applications and/or knowledge gaps identified in the Phase I reports include:

1. Managing dry weather (SSO) and wet weather (CSO) overflows through data correlation and enhanced operational practices. Correlation between weather events and operational data to identify and predict overflow events.
   a. Evaluating water quality to reduce the environmental impact of CSOs.
2. Monitoring for conditions that might cause pipe corrosion (e.g., H₂S levels) and control chemical feed.
3. Water quality impacts on receiving waters, river/surface waters, during extreme weather events.
4. Capacity issues (includes infiltration/inflow (I&I)).
5. More efficient asset management and failure prediction (to determine optimum time for intervention).
6. Real-time modeling driven with real-time sensor data.
7. Tools for optimization of sensor placement within the sewershed.
8. SSO mitigation using simple level sensors.

Source/Type 2: Automation of Quality Assessment and Quality Control Checks for Data

Develop and test procedures and tools to enhance the automation of QA/QC checks for monitoring data. Key deliverables of interest include:

1. Checking for the reasonableness of data (e.g., is the flow value measured appropriate for the contributing rainfall and catchment characteristics, is the rainfall recorded reasonable given the adjacent conditions, etc.).
2. The ability to automatically flag if there is a concern related to the functionality of the monitoring equipment (e.g., sensor damage/fouling, field communication failure, etc.).
3. The ability to assess and predict patterns such that deviations or abnormalities not related to equipment malfunction can be flagged (e.g., change in site conditions that results in a slow degradation of data quality which is insufficient to trigger a sudden failure alarm).
4. A review of the potential to use Artificial Intelligence advances to provide enhanced QA/QC functionality.

Source/Type 3: Data Use Mapping and Database Management

Develop and test methodologies to assist utilities with planning for existing and future data management needs. This includes an assessment of how existing data is currently managed and organized, as well as how systems could be developed in the future to prepare for the anticipated increase in data volume and variety. General suggested categories include:

1. Data Use Mapping and Associated Business Processes
   a. Data Use Mapping:
      i) Identify and map out current and future data sources, uses, users, and needs.
      ii) Identify gaps and make recommendations for future efforts.
b. Business Process Mapping Related to Data:
   i) Identify and create current process maps related to data management and usage.
   ii) Identify gaps and make recommendations for future process development.
   iii) Assist with implementation where appropriate and within budget limits.

2. Database Management

   a. Database Storage:
      i) Review current database storage methods.
      ii) Assess potential improvement and/or consolidation options.
      iii) Assist with implementation where appropriate and within budget limits.

   b. Database Integration:
      i) Review current database integration methods.
      ii) Assess potential improvements to enhance integration.
      iii) Assist with implementation where appropriate and within budget limits.

Proposers are invited to propose projects from any or all three of the Source/Type categories, but Source/Type 2 must be included with all submissions and the suggested categories in Source/Type 3 must also be included at least at a cursory level. **Note that Metro Vancouver, as a major funder and participating pilot study partner, is particularly interested in projects associated with QA/QC, as this is a particular challenge. Due to their current plans to significantly expand monitoring activities, it is considered to be their top priority.**

A call with a representative of Metro Vancouver will be held on Thursday, February 13, 2020 from 1:00 to 2:30 PM PST (4:00-5:30 PM EST) to answer any questions particular to MV’s partial funding of this project. The call will last for approximately one hour, thirty minutes. It is suggested for proposers to send questions in advance to the WRF Program Director, Walter Graf wgraf@waterrf.org by Monday February 10, 2020 to allow MV to develop responses in advance. The call will be recorded and all submitted questions will be available by request. **Dial in details are here.**

**Expected Deliverables**
Suggested key tasks and deliverables for the Phase II study include, but are not limited to:

1. Identification of utility partners and other potential partners to conduct multiple pilot case studies.
2. Implementation of the proposed work plan for each case study identified.
3. Documentation of the guidelines, methodology, or framework developed during each case study.
4. Documentation of the key results and lessons learned from each case study.
5. Preparation of a final report and a summary presentation to convey the key findings and lessons learned to a wider audience.

**Communications Plan**
Please review WRF’s **Project Deliverable Guidelines** for information on preparing a communications plan. The guidelines are available at [https://www.waterrf.org/project-report-guidelines](https://www.waterrf.org/project-report-guidelines) under the Preparing Research Deliverables section. Conference presentations, webcasts, peer review publication submissions, and other forms of project information dissemination are typically encouraged.

**Project Duration**
The anticipated period of performance for this project is 18-24 months from contract start date.

Confidentiality
The successful Proposer (if any) to whom the award is made may be required to enter into separate confidentiality or non-disclosure agreements with Metro Vancouver and other utilities or organizations involved with demonstration projects or as study partners. Such agreements will be prepared by Metro Vancouver or the other utilities or organizations in their required form.

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 a required list for consideration.
- Designing Sensor Networks and Locations on an Urban Sewershed Scale (Phase I) (SENG6R16/4835)
- Leveraging Other Industries – Big Data Management (Phase I) (SENG7R16/4836)

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 20 points)
• Communication Plan, Deliverables, and Applicability (maximum 15 points)
• Budget and Schedule (maximum 15 points)

Proposal Preparation Instructions
Proposals submitted in response to this RFP must be prepared in accordance with the WRF document Guidelines for Research Priority Program Proposals. The current version of these guidelines is available at https://www.waterrf.org/proposal-guidelines, along with Instructions for Budget Preparation. The guidelines contain instructions for the technical aspects, financial statements, indirect costs, and administrative requirements that the applicant must follow when preparing a proposal.

Eligibility to Submit Proposals
Proposals will be accepted from domestic or international 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. The policy can be reviewed at https://www.waterrf.org/policies. 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, both available at https://www.waterrf.org/proposal-guidelines.

**Budget and Funding Information**

The maximum funding available from WRF for this project is $340,000. The applicant must contribute additional resources equivalent to at least 33 percent 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 percent to the project, but the maximum WRF funding available remains fixed at $340,000. **Proposals that do not meet the minimum 33 percent of the project award will not be accepted.** Consult the Instructions for Budget Preparation available at https://www.waterrf.org/proposal-guidelines under the forms section of the Research Priority Program 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. The policy can be reviewed at https://www.waterrf.org/policies.

**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 2:00 pm Mountain Time on Monday, March 30, 2020.** All proposal documents must be compiled into two (2) PDF files consisting of your technical review documents and your financial review documents. All forms and components of the proposal are available in the Proposal Component Packet zip file on the proposal website at https://www.waterrf.org/open-rfps. An FAQ and a tutorial are also available. A login is required to access the proposal website and download the packet. Proposers are encouraged to create logins and verify the validity and compatibility of the system well in advance in order to avoid last-minute errors or delays.

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.
Questions to clarify the intent of this RFP and WRF’s administrative, cost, and financial requirements may be addressed to the WRF Program Director, Walter Graf (571) 384-2102, wgraf@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 an interest in possible participation in this research. This information is updated within 24 business hours when a utility submits a volunteer form and this RFP will be re-posted with the new information. *(Depending upon your settings, you may need to click refresh on your browser to load the latest file.)*

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