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REQUEST FOR PROPOSALS (RFP)

Assessing the Microbial Risks and Potential Impacts from Stormwater Collection and Uses to Establish Appropriate Best Management Practices (RFP 5034)

Due Date: Proposals must be received by 2:00 pm Mountain Time on Tuesday, September 24, 2019

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

Project Sponsors

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

Project Objective

- To assess the microbial risks and potential impacts from stormwater collection and onsite reuse to help establish appropriate best management practices for stormwater harvesting/reuse and other stormwater control measures.
- To better understand the severity of stormwater microbial contamination from fecal indicator bacteria and other pathogens, types and concentration of microbes, as well as growth over time in a variety of common stormwater scenarios.
- To use the *Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-potable Water Systems* (SIWM10C15) to develop a "Roadmap" that can guide utilities/stormwater managers in assessing site-specific microbial risks associated with stormwater collected for intended uses.
- To synthesize key methods and strategies in assessing baseflow and rain/snowmelt event microbial indicators to aid risk management based on evolving log-reduction pathogen targets.

Budget

Applicants may request up to **\$75,000** in WRF funds for this project. WRF funds requested and total project value are evaluation criteria considered in the proposal selection process.

Background and Project Rationale

Pathogens are one of the common pollutants in stormwater runoff. The fate and transport of pathogens in stormwater flows can vary widely, resulting in very different pathogen concentrations.

National and international guidance has recently been published for pathogen management associated with stormwater systems (Sharville et al., 2017; CSA/ICC, 2018 & second edition including American National Standards Institute). In these guidelines, log-reduction targets (LRT) addressing enteric pathogens (viral, bacterial, and parasitic protozoan) were developed largely around the level of sewage contaminating collected stormwater (Schoen et al., 2017), with expected animal production/manure

runoff next most important, and wildlife excreta the least (Soller et al., 2015). Even in stormwater collection systems that are separated from municipal sewers, sewage ingress occurs within urban areas through various pathways, including cross-connections, leaking sewers, and rain-induced overflows to stormwater collection systems. While leaking sewers/cross connections may result in chronic base-flow sewage contamination, rain/snowmelt events provide pathways for sporadic contamination – typically resulting in at least a one-in-a-thousand dilution (10^{-3}) of sewage in urban stormwater and up to only a 10^{-1} dilution of raw sewage when cross-connections are more chronic. Hence, the two levels of LRTs provided in the guidelines now considered for stormwater uses in San Francisco, and that human enteric viruses represent the microbial group requiring the highest LRT (Sharvelle et al., 2017).

However, for any specific site, there is a need to consider existing fecal indicator bacteria (FIB) data during baseflow and rain/snowmelt event conditions to ascertain the range in fecal contamination, and resolve between sewage and other potential animal fecal contributions using source-specific markers (which largely do not contain human-infectious waterborne viruses). Secondary concerns may arise when using the existing LRT due to lack of knowledge on key viruses like Norovirus, for which quantitative infectivity data is not available for virions that have undergone environmental storage/deterioration. How key viruses may aggregate or otherwise change from virions were presented in the original human dose-response study using healthy young adults (Teunis et al., 2008). Some of these issues may be accounted for from a more recent evaluation of various dose-response studies (Messner et al., 2012).

In summary, there is a need to expand the risk-based framework developed in the report *Risk-Based Framework for the Development of Public Health Guidance for Decentralized Non-potable Water Systems* (SIWM10C15) and more broadly assess the enteric and non-enteric microbial risks and potential impacts from stormwater collection and uses to help establish risk-based, best management practices. This study will benefit utilities by formulating a mitigation strategy for exposure risks relating to pathogens from stormwater, as well as for stormwater harvesting applications and enhancing the protection of public health.

Quantitative microbiological risk assessment (QMRA) is the process of estimating the risk from exposure to pathogens. The process involves evaluating reference pathogens by direct measures or via indicators and running Monte Carlo simulations to estimate the risk of infection/disease. However, little data is available that characterizes stormwater pathogen profiles such as the expected types and quantities of enteric viruses, bacteria, and parasitic protozoa in stormwater. Such data that can be used to support QMRA for stormwater harvesting/reuse including roof runoff is limited. Furthermore, the transport pathways including types of surfaces that stormwater flows to the point of collection for treatment and/or stormwater reuse/harvesting can vary widely resulting in very different pathogen profiles and concentrations. It is important to gain more in-depth understanding regarding severity of stormwater microbial contamination, types, and concentration of microbes, based on comprehensive literature review and survey of utilities and municipalities.

Research Approach

(1) Literature Review

The research team will evaluate the state of knowledge of types of stormwater management systems (e.g., through National Stormwater Quality Database (NSQD), International Stormwater BMP Database, and other available sources) and how QMRA has been applied to stormwater harvesting/reuse (including roof runoff) and stormwater discharge to receiving waters in different geographic regions and climates and for different user-classes.

(2) Synthesis Report

The research team will prepare a detailed annotated outline of the synthesis report and submit it for Project Advisory Committee (PAC) review. The synthesis report is expected to provide a risk-based framework and associated monitoring requirements for onsite stormwater reuse practices and their intended uses (e.g., industrial use and agricultural irrigation). After the PAC's review, the research team will prepare a report that addresses the use of the QMRA process in support of appropriate best management practices (e.g., hazard identification, dose-response, exposure assessment, and risk characterization) and the associated type of monitoring needed to develop site-specific management of microbial risks in stormwater.

(3) Discussion of the Findings with PAC and Participating Utilities through a Webcast

The research team will discuss the draft findings with the PAC and participating utilities through a webcast/web-based workshop. The research team will prepare the workshop agenda, facilitate the workshop discussion, and prepare a synthesis document containing a summary of the workshop and workshop discussion outcomes.

(4) Roadmap Document

Based on the above, the research team will develop a roadmap (e.g., using a logic tree approach) that can guide utilities/stormwater managers in the decision-making process, based on source contamination potential from historical data and transport pathway, sanitary survey, and intended end uses.

Expected Deliverables

- (1) A stand-alone summary report from literature review, including all supporting documents obtained from that effort (e.g., copy of peer-reviewed articles and reports).
- (2) A synthesis report with case studies through literature review and phone conversations/interviews with selected utilities/municipalities, including a summary of QA/QC protocols that are used for collecting different types of stormwater microbial data.
- (3) Workshop agenda and synthesis document from the web-based workshop.
- (4) A "roadmap" document that can guide utilities/stormwater managers in how to assess site-specific microbial risks associated with stormwater collected for intended uses.
- (5) Outreach materials such as a webcast, abstracts/presentations at national conferences, and one peer-reviewed journal article.

Communications Plan

Please review WRF's *Project Deliverable Guidelines* for information on preparing a communications plan. The guidelines are available at <http://www.waterrf.org/funding/Pages/proposal-guidelines.aspx>. 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 months** from the contract start 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.

References

- ASCE (2014). Pathogens in Urban Stormwater Systems. (Available at: <http://www.asce-pgh.org/Resources/EWRI/Pathogens%20Paper%20August%202014.pdf>)
- Canadian Standards Association (CSA) /International Code Council (ICC) (2018). Rainwater Harvesting Systems, Standard CSA B805-18/ICC 805-2018, National Standard of Canada. In Standards Council of Canada: Toronto, Ontario; p 93.
- Messner, M.J.; Berger, P.; Nappier, S.P. (2014). Fractional Poisson—a simple dose-response model for human norovirus. *Risk Anal*, 34, (10), 1820-9.
- Schoen, M.E.; Ashbolt, N.J. (2010). Assessing pathogen risk to swimmers at non-sewage impacted recreational beaches. *Environ Sci Technol*, 44, (7), 2286-2291.
- Schoen, M.E.; Ashbolt, N.J.; Jahne, M.A.; Garland, J. (2017). Risk-based enteric pathogen reduction targets for non-potable and direct potable use of roof runoff, stormwater, greywater, and wastewater. *Microbial Risk Analysis*, 5, 32-43.
- Sharvelle, S.; Ashbolt, N.; Clerico, E.; Hultquist, R.; Leverenz, H.L.; Olivieri, A. Risk Based Framework for the Development of Public Health Guidance for Decentralized Nonpotable Water Systems (2017). Prepared by the National Water Research Institute for the Water Environment & Reuse Foundation, WE&RF Project Number SIWM10C15; Water Environment & Reuse Foundation Alexandria, VA; p 118.
- Soller, J.; Bertrand, T.; Ravenscroft, J.; Molina, M.; Whelan, G.; Schoen, M.; Ashbolt, N. (2015). Estimated human health risks from recreational exposures to stormwater runoff containing animal fecal material. *Environ Modelling Software*, 72, (October), 21-32.
- Teunis, P.F.; Moe, C.L.; Liu, P.; Miller, S.E.; Lindesmith, L.; Baric, R.S.; Le Pendu, J.; Calderon, R.L. (2008). Norwalk virus: How infectious is it? *Journal of Medical Virology*, 80, (8), 1468-76.
- Pitt, R. (2010). Potential Human Health Effects Associated with Stormwater Discharges. In *Stormwater Quality Management*.
- Water Environment Research Foundation (WERF) (2007). Development of a Protocol for Risk Assessment of Microorganisms in Separate Stormwater Systems. Project Number 03-SW-2.
- Water Research Foundation (WRF) (2010). Watershed Pathogen Modeling for Risk Management and Load Estimations. Report Number 3124.

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 <http://www.waterrf.org/funding/Pages/proposal-guidelines.aspx>, 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 <http://www.waterrf.org/funding/Pages/policies.aspx>. 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 <http://www.waterrf.org/funding/Pages/proposal-guidelines.aspx>.

Budget and Funding Information

The maximum funding available from WRF for this project is **\$75,000**. 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 **\$75,000**.

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 <http://www.waterrf.org/funding/Pages/proposal-guidelines.aspx> 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 <http://www.waterrf.org/funding/Pages/policies.aspx>.

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 Tuesday, September 24, 2019. 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://proposals.waterrf.org/Pages/RFPs.aspx>. 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 project contact, Harry Zhang, PhD, PE, Program Director at (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 upon your settings, you may need to click refresh on your browser to load the latest file.)**

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