REQUEST FOR PROPOSALS (RFP)

Integrating Nature-based Solutions and Gray Infrastructure to Optimize Treatment Performance (5248)

Date Posted
Monday, September 11, 2023

Due Date
Proposals must be received by 3:00 pm Mountain Time on Tuesday, November 21, 2023.

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

Project Objectives
- Summarize and advance the state of practice of integrating nature-based solutions with conventional/gray infrastructure treatment trains across different water matrices
- Assess water quality performance capabilities of mixed treatment trains using existing datasets, published literature values, and/or advanced tools such as simulation models
- Identify socio-technical opportunities and barriers for better integration, and evaluate proposed solutions for energy, chemical, and/or other operation and maintenance cost savings
- Perform a triple bottom line (or similar) analysis to holistically evaluate the tradeoffs of mixed treatment trains vs. full conventional/gray or full nature-based

Budget
Applicants may request up to $225,000 in WRF funds for this project.

Background and Project Rationale
Traditional engineering design approaches for treatment of varying water sources (e.g., wastewater, graywater, reverse osmosis concentrate, and stormwater) can lead to a binary paradigm of conventional/gray infrastructure vs. nature-based solutions. As one of the most widely accepted definitions, nature-based solutions (NbS) are actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously benefiting people and nature (IUCN, 2016). For illustration purposes, a few examples of NbS across different water matrices (drinking water,

wastewater, stormwater, and reuse) can include green stormwater infrastructure, riverbank filtration, managed aquifer recharge, and constructed wetlands. To illustrate a connection between nature-based solutions and conventional/gray infrastructure, integration of NbS could manifest as pretreatment before conventional/gray processes, advanced treatment after conventional/gray processes, or as an alternative unit process in a conventional/gray treatment train. Conversely, conventional/gray technologies can be integrated into NbS to help provide process control and meet regulatory objectives (e.g., using membrane filtration after constructed wetlands to provide water quality enhancement). Furthermore, there are other means of integration of NbS and gray structure that can help improve both water supply and quality.

There is a great need to better understand how nature-based solutions can be integrated into different parts of treatment trains across different water matrices to optimize performance, improve flow control, and accrue multiple benefits. This project will help utilities assess how NbS and conventional/gray infrastructure can be combined to meet water quality and quantity goals while providing triple-bottom-line benefits (economic, social, and environmental benefits) to communities. By assessing both types of infrastructure as unit processes to be mixed and matched, utilities will have more flexibility in designing and retrofitting their facilities to meet future regulations and climatic conditions

Potential national partners for this research study could include the United States Environmental Protection Agency (US EPA), U.S. Water Alliance, Green Infrastructure Leadership Exchange, Water Environment Federation, American Water Works Association, and The Nature Conservancy. In addition, regional partners and regional research entities should be considered for in-depth experience and regional knowledge.

Research Approach

The research team will conduct a comprehensive literature review by building from existing research, including WRF's research efforts to date. Please refer to selected examples listed in the "References and Resources" section below, which includes examples of databases such as the International Stormwater BMP Database led by WRF and supporting tools such as the Green Infrastructure Modeling Toolkit led by the U.S. EPA. In this study, NbS across different drinking water, wastewater, stormwater, and reuse should be covered (e.g., example green stormwater infrastructure, riverbank filtration, managed aquifer recharge, and constructed wetlands). Based on all available published literature, the research team will synthesize the latest information on NbS in North America and elsewhere as applicable. The research team will synthesize the latest real-world practices across geographic regions, including monitoring data on existing systems by focusing on applications by utilities and municipalities.

The research team will develop a utility-facing "state-of-the-practice" guidance document, which includes a synthesis of case studies, available data sources, and advanced tools/simulation models across different geographic regions and utility sizes, focusing on utilities and municipalities in North America. In addition, a separate chapter in the guidance document will be included to summarize the knowledge gaps, research needs, and preliminary

project concepts for recommended future research projects by considering the state-of-the-art in North America and across the globe.

To enhance the practical applicability of the utility-facing guidance document, a utility-focused invitation-only virtual workshop will be held to seek feedback and real-world examples from utilities and municipalities across geographic regions. The virtual workshop participants will also include the 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 conduct one webcast hosted by WRF and collaborating organizations on the overall findings of this project. The research team is 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 comprehensive literature synthesis document that summarizes the state of practice of integrating nature-based solutions with conventional/gray infrastructure treatment trains across different water matrices
- A user-friendly utility-facing guidance document and catalog of options outlining how nature-based solutions and conventional/gray processes can fit together
    - Summary of analysis of triple bottom line (economic, social, and environmental) considerations for a spectrum of treatment process trains (gray infrastructure to nature-based solutions)
    - Summary of detailed case studies and examples of successful (or unsuccessful) integration of nature-based solutions and conventional/gray treatment processes
    - A list of research needs and proposed preliminary research concepts for future consideration
- A utility-focused invitation-only virtual workshop 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:
    - Conduct webcasts and deliver public outreach materials such as conference presentations
    - Submit one open access peer-reviewed journal paper and additional outreach products as applicable

Communication Plan

Please review WRF's *Project Deliverable Guidelines* for information on preparing a communication plan. The guidelines are available at https://www.waterrf.org/project-report-guidelines#project-deliverable-guidelines. 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 24 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.

- Clary, J., J. Jones, M. Leisenring, P. Hobson, and E. Strecker. 2020. *International Stormwater BMP Database: 2020 Summary Statistics.* Project 4968. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/projects/annual-update-international-stormwater-bmp-database-and-expanding-communication
- Clements, J., J. Henderson, and A. Flemming. 2021. *Economic Framework and Tools for Quantifying and Monetizing the Triple Bottom Line Benefits of Green Stormwater Infrastructure.* Project 4852. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/projects/economic-framework-and-tools-quantifying-and-monetizing-triple-bottom-line
- Drewes, J. E., C. Hoppe, G. Oldham, J. McCray, and K. Thompson. 2009. *Removal of Bulk Organic Matter, Organic Micropollutants, and Nutrients During Riverbank Filtration.* Project 3180. Denver, CO: Water Research Foundation. https://www.waterrf.org/research/projects/removal-bulk-organic-matter-organic-micropollutants-and-nutrients-during
- International Union for Conservation of Nature (IUCN). 2016. *Defining Nature-based Solutions.* Resolution Number: WCC-2016-Res-069. IUCN.
- International Union for Conservation of Nature (IUCN). 2020. *IUCN Global Standard for Nature-based Solutions (First Edition).* https://www.iucn.org/resources/publication/iucn-global-standard-nature-based-solutions-first-edition
- Lechler, B. J., M. Lucas, L. Schimmoller, and D. Davis. 2022. *Geochemical Considerations for Managed Aquifer Recharge Implementation in Potable Reuse.* Project 5051. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/projects/geochemical-considerations-managed-aquifer-recharge-implementation-potable-reuse
- Luthy, R., and D. Sedlak. 2017. *Enhanced Removal of Nutrients and Trace Organic Contaminants in Pilot-Scale Stormwater Treatment Systems*. Project 4567. Denver, CO: Water Research Foundation. https://www.waterrf.org/research/projects/enhanced-removal-nutrients-and-trace-organic-contaminants-pilot-scale-stormwater
- Nemcik, J., F. Krupa, S. Ozana, and Z. Slanina. 2022. Wastewater Treatment Modeling Methods Review. *International Federation of Automatic Control (IFAC)-Papers OnLine,* 55 (4): 195-200. https://doi.org/10.1016/j.ifacol.2022.06.032
- Brooks, B. W., C. K. Chambliss, D. L. Sedlak, and R. L. Knight. 2011. *Evaluate Wetland Systems for Treated Wastewater Performance to Meet Competing Effluent Quality Goals.* Project 1610. Alexandria, VA: WateReuse Research Foundation.

https://www.waterrf.org/research/projects/evaluate-wetland-systems-treated-wastewater-performance-meet-competing-effluent

- McPhearson, T., N. Kabisch, and N. Frantzeskaki. 2023. *Nature-Based Solutions for Cities.* Edward Elgar Publishing Limited.
- Pecson, B., and B. Post. 2020. *Onsite Non-Potable Water System: Guidance Manual and Training Modules.* Project 4909. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/projects/onsite-non-potable-water-system-guidance-manual-and-training-modules
- Rauch-Williams, T., J. Mosher, J. E. Drewes, V. Zhiteneva, and C. Gerba. 2023. *State-of-the-Science Review: Evidence for Pathogen Removal in Managed Aquifer Recharge Systems*. Project 4957. Denver, CO: The Water Research Foundation.
- Scholes, R. C., A. N. Stiegler, C. M. Anderson, and D. L. Sedlak. 2021. Enabling Water Reuse by Treatment of Reverse Osmosis Concentrate: The Promise of Constructed Wetlands. *ACS Environ.,* 1 (1): 7–17. https://pubs.acs.org/doi/10.1021/acsenvironau.1c00013
- Serdarevic, A. and A. Dzubur. 2016. Wastewater process modeling. *Coupled Systems Mechanics*, 5 (1): 21–39. https://doi.org/10.12989/csm.2016.5.1.021
- Sharvelle, S., J. Alja'fari, A. Branch, and J. Rasmus. 2023. *Assessing the Microbial Risks and Impacts from Stormwater Capture and Use to Establish Appropriate Best Management Practices*. Project 5034. Denver, CO: The Water Research Foundation. https://www.waterrf.org/research/projects/assessing-microbial-risks-and-impacts-stormwater-capture-and-use-establish
- Storck, F. 2010. *Removal and Fate of EDCs and PPCPs in Bank Filtration Systems*. Project 3136. Denver, CO: Water Research Foundation. https://www.waterrf.org/research/projects/removal-and-fate-edcs-and-ppcps-bank-filtration-systems
- Trussell, S., B. Trussell, Y. Qu, and R. Trussell. 2017. *Soil Aquifer Treatment Characterization with Soil Columns for Groundwater Recharge in the San Fernando Valley*. Project 4600. Denver, CO: Water Research Foundation. https://www.waterrf.org/research/projects/soil-aquifer-treatment-characterization-soil-columns-groundwater-recharge-san
- United States Environmental Protection Agency (US EPA). 2023. *Green Infrastructure Modeling Toolkit.* US EPA. Accessed August 22, 2023. https://www.epa.gov/water-research/green-infrastructure-modeling-toolkit
- White House Council on Environmental Quality, White House Office of Science and Technology Policy, White House Domestic Climate Policy Office. 2022a. *Opportunities for Accelerating Nature-Based Solutions: A Roadmap for Climate Progress, Thriving Nature, Equity, and Prosperity.* Report to the National Climate Task Force. Washington, D.C. White House Council on Environmental Quality.
- White House Council on Environmental Quality, White House Office of Science and Technology Policy, White House Office of Domestic Climate Policy. 2022b. *Nature-Based Solutions Resource Guide (Compendium of Federal Examples, Guidance, Resource Documents, Tools, and Technical Assistance).* Washington, D.C. White House Council on Environmental Quality.

- Westerhoff, P., F. Sharif, R. Halden, P. Herckes, and R. Krajmalnik-Brown. 2014. *Constructed Wetlands for Treatment of Organic and Engineered Nanomaterial Contaminants of Emerging Concerns*. Project 4334. Denver, CO: Water Research Foundation. https://www.waterrf.org/research/projects/constructed-wetlands-treatment-organic-and-engineered-nanomaterial-contaminants
- The Water Research Foundation (WRF). 2023. *Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (CLASIC).* WRF. https://www.waterrf.org/clasic

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*. The current version of these guidelines and the *Instructions for Budget Preparation* are available at https://www.waterrf.org/proposal-guidelines. The 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 tools, such as websites, Excel spreadsheets, Access databases, etc., must follow the criteria outlined for web tools presented in the *Web Tool Criteria and Feasibility Study for The Water Research Foundation Project Deliverables* at https://www.waterrf.org/project-report-guidelines#webtool-criteria.

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. 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 Preparatio*n, both available at https://www.waterrf.org/proposal-guidelines.

Budget and Funding Information
The maximum funding available from WRF for this project is $225,000. 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 $225,000. Proposals that do not meet the minimum 33% of the project award will not be accepted. Consult the *Instructions for Budget Preparation* available at https://www.waterrf.org/proposal-guidelines#RPP-instr-budget-prep 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 3:00 pm Mountain Time on Tuesday, November 21, 2023.

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-5248R .

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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