



REQUEST FOR PROPOSALS (RFP)

The Emergence of Artificial Intelligence: Opportunities and Challenges for Water Resources Planning (5290)

Date Posted

Friday, September 20, 2024

Due Date

Proposals must be received by 3:00pm Mountain Time on Thursday, November 21, 2024.

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

- Identify potential uses and benefits of artificial intelligence (AI) in Water Resources Planning to support routine operations and address uncertainties related to changing climate (e.g., supply and demand forecasting, operational technology solutions, etc.).
- Identify potential challenges associated with AI tool implementation and develop guidance for utilities to evaluate options and prepare for future AI use (e.g., modifications to data collection, cleaning, processing procedures).
- Identify and recommend pathways and/or organizational approaches for the water sector to monitor potential uses of AI that could be available in the future.
- Review and catalogue AI tools available or in development that are specific to Water Resources Planning, with an eye towards identifying publicly available and/or open-source tools.

Budget

Applicants may request up to \$175,000 in WRF funds for this project.

Background and Project Rationale

The emergence of AI applications in the water sector provides a significant opportunity for water resources planning and management through advanced tools for modeling, data analysis (including identifying trends and patterns), prediction, optimization, and decision-making. The use of AI can enhance water resources planning through a multitude of ways, including the abilities to more effectively predict short- and long-term demand, manage and model

availability and quantity of supplies, predict potential impacts of climate change to both supply and demand, implement conservation efforts, optimize water delivery and distribution via smart infrastructure, make more informed policy decisions, and evaluate or plan for future water supply investments. Numerous studies have been completed recently, each highlighting the expansive potential applications of AI as listed above (examples include Saxena et al. 2024; Mahardhika and Putriani 2023; Kamyab et al. 2023). These recent publications demonstrate the rapidly expanding suite of potential tools for utilities and the significant undertaking that lies ahead for those interested in employing AI for planning and forecasting needs.

For water resources planners, several key challenges propel this project forward:

1. **Data Overload:** Water utilities and consultants are inundated with data—streamflow measurements, precipitation records, groundwater levels, and more. Extracting meaningful insights from this deluge is a major challenge.
2. **Complexity of Systems:** Water systems are intricate, interconnected networks. Managing them effectively requires understanding dynamic relationships between variables such as precipitation, aquifer recharge, reservoir levels, and water quality.
3. **Resource Scarcity:** Scarce water resources necessitate optimal allocation. AI can help predict demand, optimize distribution, and identify conservation opportunities.
4. **Climate Uncertainty:** Climate change introduces unpredictability. AI models can enhance resilience by forecasting extreme events, such as droughts or floods.

Focused research is needed to bridge the gap between traditional water management planning and the digital age to provide support for water utilities as they grapple with these challenges and navigate the ever-evolving world of AI. Utilities must find the optimal pathways for enhancing their current planning practices and embracing operational technology solutions, while ensuring continued safe, reliable, and cost-effective water resources management.

Proposals in response to this RFP should aim to identify potential applications, benefits, and challenges of AI specific to water resources planning and develop guidance to support utility planners as they determine where to invest time and resources in exploration, monitoring, and implementation of AI technologies. Proposed projects should aim to support a diverse range of utilities (i.e., level of resources, size, geographic location, mission/structure, etc.) across the One Water paradigm with consideration of all potential sources of supply, both conventional and alternative. Proposers should include a plan to engage utilities and ensure practical applicability of findings.

Research Approach

This RFP is intentionally flexible in the research approach to encourage creativity and originality from proposers. Proposers should describe how they will conduct the research to meet the objectives listed above. The following approach is intended as a starting point.

- Literature/Document review of academic and sector reports and planning documents to assess the status of AI applications in water resources planning and identify areas for future application.

- Technology review of emerging AI algorithms, models, software, applications, etc., with an eye towards identifying publicly available and/or open-source tools.
- Utility engagement/case study with water resources planners and data managers regarding current capabilities, interest and need for AI tools, potential benefits and challenges, and pathways for future growth and education.
- Interviews with AI experts (researchers and private/other sectors).

Expected Deliverables

The deliverables for this RFP are intentionally flexible to encourage creativity and originality from proposers. Proposers should describe how the deliverables proposed will provide wide sector accessibility and ensure practical applicability of the project results. Potential deliverables for this project could include, but are not limited to, the following:

- Research report (must use WRF's [Research Report Template](#))
- Literature review
- Guidance manual
- Webcast, conference presentation, etc.
- Peer-reviewed journal article
- Fact sheet, case study, white paper, etc.
- Workshop (consider plan to document workshop)
- Technology Deliverable (e.g., website, online tool/database, etc.) (must follow the [Technology Deliverables Guidance](#))

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 12-18 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.

- Kamyab, H., T. Khademi, S. Chelliapan, M. SaberiKamarposhti, S. Rezania, M. Yusuf, M. Farajnezhad, M. Abbas, B. H. Jeon, and Y. Ahn. 2023. The latest innovative avenues for the utilization of artificial Intelligence and big data analytics in water resource management. *Results in Engineering*, 20: 101566. <https://doi.org/10.1016/j.rineng.2023.101566>.

- Mahardhika, S. P., and O. Putriani. 2023. Deployment and Use of Artificial Intelligence in Water Resources and Water Management. IOP Conf. Ser.: *Earth Environ. Sci*, 1195: 012056.
- Saxena, R., V. Srivastava, D. Bharti, R. Singh, A. Kumar, and A. Sharma. 2024. Artificial Intelligence for Water Resource Planning and Management. *Innovations in Machine Learning and IoT for Water 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 tools, such as websites, Excel spreadsheets, Access databases, etc., must follow the criteria outlined for web tools 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 \$175,000. 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 \$175,000. 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, November 21, 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-5290>

Questions to clarify the intent of this RFP and WRF's administrative, cost, and financial requirements may be addressed to the WRF project contact, Lyndsey Bloxom at lbloxom@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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