2027 ITRC Project Team Proposal Form

ENVIRONMENTAL TOPIC:

Best management practices and beneficial reuse of industrial wastewater from various sources.

PROJECT TITLE:

Management of Brines, Brackish and Produced Water for Beneficial End Use

PROBLEM STATEMENT:

Water shortages and problems related to increasing demands for water rank front and center as environmental challenges of our time, shaping everything from public health to economic stability. Future economic development and environmental preservation require innovative technical approaches for water resource management and beneficial reuse. With technological advances in water treatment technologies, industrial sources of contaminated water once considered unusable waste, as well as other sources of marginal quality waters, could now provide additional sources of water for communities facing dire shortages. Major potential sources of marginal quality waters include brackish and saline aquifers, produced water from oil and gas and other industrial operations, and brine from solution mining, water treatment residuals, and cooling tower blowdown water.

A prime example of marginal source water is produced water from oil and gas production. As of 2024, operations in the Permian Basin area of New Mexico and Texas were producing up to 12 million barrels of produced water per day, often at a ratio of 4 to 5 barrels of water for every barrel of oil extracted. Historically, the cost of treating produced water typically outweighed the cost of disposal, and as a result, 91% of produced water from oil and gas operations in the United States in 2012 was disposed of via underground injection or reinjected for the purposes of enhanced oil recovery. The expansion of oil and gas production and the water intensiveness of hydraulic fracturing methods have increased both the demand for new water supplies and the generation of produced water. This combined with diminishing capacity for underground injection disposal puts additional strain on the "Water-Energy Nexus" and creates an urgent need to identify alternative approaches for management and reuse of produced water throughout the United States and across the globe.

Thanks to rapidly advancing technologies, produced water is now being examined by many states as a complementary, non-freshwater resource that can be treated and directed to industrial, energy, and certain non-potable uses to preserve limited potable water supplies. Treated (desalinated and polished) produced water is also being considered for potential aquifer storage and recovery where it is injected into a usable supply of drinking water for later recovery. Strong environmental safeguards and transparent permitting programs that include monitoring and clear safe standards are needed to ensure the safety of end users. Various states are currently codifying rules for treatment, management, and reuse of produced water into state law, including New Mexico, Colorado, North Dakota, Oklahoma, Texas, Kansas, Arkansas, Louisiana, Montana, Pennsylvania, and Ohio. Disparate regulatory standards, criteria, and management approaches across states highlight the need for a comprehensive guidance document. For example, beneficial produced water reuse projects are regulated by State government environment departments, various commissions, and/or special permitting sections, depending on the state and the type of end use. Some existing state rules and regulations include:

- Colorado Energy and Carbon Management Commission HB-1242: mandates water conservation in oil and gas operations by reducing freshwater use and increasing produced water recycling.
- Colorado Discharge Permit System (CDPS): regulates discharges to state waters via surface water quality standards that create a functional prohibition of discharge of produced water; no operator in Colorado currently has an active CDPS permit to discharge produced water to rivers, streams, or lakes.
- New Mexico Produced Water Act (2019): provides legal clarity and encourages the oil and gas industry to recycle and treat wastewater rather than drawing on limited freshwater resources.
- New Mexico 2025 Discharge Ban: creates strict regulations (Ground and Surface Water Protection – Supplemental Requirements for Water Reuse, 20.6.8 NMAC) prohibiting both treated and untreated produced water from discharging into ground and surface waters.

- North Dakota Administrative Code: allows for limited beneficial reuse of produced water, specifically for dust and ice control on public roads, under strict approval, monitoring, and enforcement conditions.
- Pennsylvania General Permit WMGR123: authorizes beneficial reuse of oil and gas liquid waste exclusively for developing or hydraulically fracturing oil or gas wells.
- New York Codes, Rules and Regulations (6 NYCRR): allows reuse of produced water both on-site and off-site, provided it meets permitting approval or a beneficial use determination.
- Oklahoma Title 52 Sections 86.6 and 86.7, Oil and Gas Produced Water and Waste Recycling and Reuse Act: allows recycling and reuse produced water within oil and gas and related industrial operations; allows limited applications outside of oil and gas, with additional permitting and water quality and discharge standard requirements.
- Ohio Administrative Code (OAC 1501:9) and Ohio Revised Code (ORC Chapter 1509): authorizes reuse of produced water only within oil and gas operations, no other uses are allowed, including other industrial applications.
- Texas HB 2771 (2019) and SB 1145 (2025): allow discharge of treated produced water into Texas surface waters and land use applications, respectively, when treated to meet state standards.
- Virgina Administrative Code (4 VAC 25): allows on-site reuse for fracturing or reinjection through permit packages; no separate permitting exists for off-site or alternative reuse methods.

Other sources of brine, brackish water, and industrial produced water represent vast resources that could be used as additional complimentary sources of water across the country. Treatment and reuse of these waters also pose economic pathways of remediating contaminated sites and groundwater supplies. Additionally, prospects for critical mineral and element recovery from brine and produced water as well as the economic benefit to communities that can establish treatment and reuse business sectors are now recognized.

Characterization and treatment of this water present complex chemistry and engineering problems since its composition depends upon numerous factors including the original source and type of use, and the appropriate levels and types of treatment vary greatly depending on the intended end-use. The United States Geological Survey Oil and Gas Waters Project (OGW) aims to provide information regarding the quantity, quality, impact and potential reuse options for brines and produced water. Building off the foundation of existing resources such as the OGW, ITRC has the opportunity to produce comprehensive technical and regulatory guidance to bring a better understanding of the characterization, treatment, reuse, and residuals management for brine, brackish water, and industrial produced water.

A general outline of the proposed guidance is as follows:

- Introduction (glossary, overview of brine, brackish water, and industrial produced water, sources, past-present-and-future of largest producing industries, conventional disposal methods)
- Current Regulatory Environment (compare existing regulations and status of water resources across states with links to resources)
- Characterization Considerations (economic, risk assessment, and waste disposal considerations, challenges with characterization, end-use based standards criteria)
- Potential Applications (post-treatment water: site specific risk-based options for reuse, levels of treatment needed for intended end use, resource protection alternatives, waste stream: best management practices, recirculation, deep well injection, industrial reuse, road deicing, mineral recovery)
- Technology Review (current state of characterization and treatment technologies, technical limitations, emerging technologies, data gaps)
- Case Studies (highlighting regulatory and reuse success stories)

ADDITIONAL INFORMATION:

Project Deliverables: ITRC guidance document and online training webinar.
Team Timeline: 24 months.
Intended Audience: Industry professionals, the public, state and federal regulators.

Subject Matter Experts & ITRC Members that may be interested in joining:

- Jessica Hubbling, Water Resources Professional, Mining Environmental Compliance Section, New Mexico Environment Department
- Shannon Suggs, Environmental Scientist, Division of Water Quality, Groundwater Protection Program, North Dakota Department of Environmental Quality
- Bill Shafford, Technical Specialist, Office of Waste, Texas Commission on Environmental Quality
- Rich Murray, P.E, PFAS and Emerging Contaminants Coordinator, Colorado Department of Public Health and Environment
- James Robinson, P.E., Underground Injection Control (UIC) Section, Texas Commission on Environmental Quality
- David Cates, Land Protection Division, Waste Permitting Section, Oklahoma Dept. of Environmental Quality
- Lei Hu, Lead Water Resources Professional, Pollution Prevention Section, New Mexico Environment Department
- USGS Oil and Gas Waters Project potential contacts:
- Andrew L. Masterson, Ph.D., Research Chemist at the Geology, Energy & Minerals Science Center
- Seth Haines, Research Geophysicist at the Central Energy Resources Science Center

Contemporary Body of Research (organized by outline section)

- **Introduction**

Eyitayo, S. I., Watson, M. C., Kolawole, O., Xu, P., Bruant, R., & Henthorne, L. (2024). External utilization of oil and gas produced water: Why is the industry hesitant to full-scale implementation? *Environment, Development and Sustainability, 26*(1), 89–108. https://doi.org/10.1007/s10668-022-02746-0

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- **Regulatory Environment**

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- **Characterization**

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➢ **Potential Applications**

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➢ **Technology Review**

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