

Development of a National Research Strategy for Water Reuse

WRAP Action 7.2 Scope of Work

Purpose

The Water Research Foundation (WRF) and Steering Committee developed a scope of work in November 2020 (updated Feb 2021 and June 2022) to define the scope and scale of this action and final action output(s).

Introduction

The National Water Reuse Action Plan (WRAP) facilitated by U.S. EPA has identified a series of actions to further the acceptance and practice of water reuse in the United States. Action 7.2 – *Develop a National Research Strategy for Water Reuse* – aims to identify research needs and key stakeholders that can provide the necessary scientific underpinning to support operations and policy decisions by regulatory agencies and utilities. This action is complex due to the various source waters, end use applications, and research challenge types – all impacted by state/regional considerations (Figure 1).

Therefore, we will approach the research strategy development in phases, ordered by our September 2020 survey results (Attachment A). The first phase will utilize WRF

research underway to determine needs for stormwater capture and use. Then phase 2 will begin with the evaluation of research needs for the continued advancement of municipal potable water reuse. Subsequent work will evaluate research needs for specific applications such as on-site residential and commercial reuse, stormwater capture and use, and reuse for urban irrigation.

Objectives

This work seeks to understand and identify key research gaps that exist in the various applications of recycled water and provide a robust research strategy to bridge these gaps and enable the expanded practice of water reuse nationwide.

A robust research strategy will include the following:

- Identify **current and planned research** conducted by federal and state agencies, non-governmental organizations (NGOs) entities, and universities to reduce duplication of efforts, create partnerships, and leverage synergies.

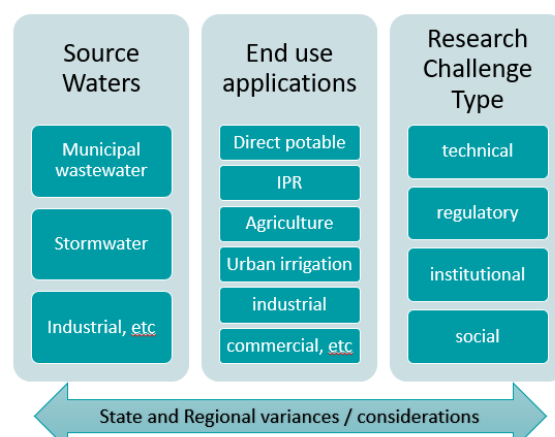


Figure 1. Various Considerations for Strategy Development

- Consider **One Water and integrated water approaches** that build on adaptive management principles.
- Identify **key participants** currently or potentially implementing water reuse that can contribute data, experiences, and/or testing sites for future research.
- Develop **research questions** that can be addressed and lead to actionable information for operational, regulatory, and policy decision-making.

Background

The National Academies reported that the U.S., through various reuse efforts, used 2 billion gallons of wastewater per day (BGD) in 2008 (NRC, 2012). That is approximately 6% of the 32 BGD of wastewater generated nationwide. While certain communities/regions are or have plans to successfully integrate reuse into their diversified water portfolio (e.g. Gwinnett County, Loudoun County, San Diego, LA, etc), states and the nation can better foster reuse to grow this sustainable supply.

To date, important research has been conducted by federal agencies (e.g., EPA, the Bureau of Reclamation, and Department of Energy), academia, utilities, and NGOs (e.g., Water Research Foundation (WRF), National Water Research Institute, ReNUWit,) on a variety of topics related to the advancement and implementation of water reuse across the United States. A national strategy including enhanced coordination of past and future water reuse research can optimize its value, better identify critical gaps, and speed delivery of results to the sector.

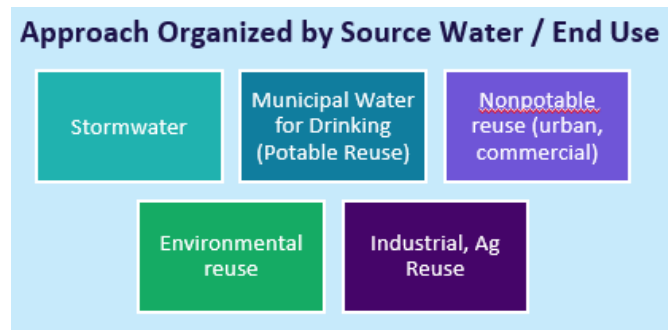
Because water reuse has different drivers by region, the approaches, regulations, and experiences vary on a regional basis. A survey conducted by WRF in the fall of 2020 supports a regional approach to water reuse research, and identified the following unique regions based on geographic, water availability, and regulatory characteristics. However, there are no national regulations for water reuse, therefore taking a state approach may be necessary in some cases (e.g. Florida). The project team can determine the best approach with the PAC.

- California
- West (non-CA) – Nevada, Utah, Colorado
- Pacific Northwest – Oregon, Washington, Idaho
- Southwest – Arizona, New Mexico
- Midwest
- South Central – Texas, Oklahoma
- South
- Southeast - Florida, Georgia, North and South Carolina
- Mid-Atlantic – Maryland, Virginia, D.C.
- Northeast

It is recommended that the research strategy address/incorporate non-technical but important emerging needs/trends in addition to the traditional drivers. These concepts include:

- The use of One Water (not yet universal) and integrated water management (more universal) and these apply to reuse.
- How decentralized reuse fits into the strategy, it is an emerging trend and is different from onsite reuse.

- Climate resiliency and adaptation.
- Accounting for multiple benefits (co-benefits), especially important where water scarcity is not the primary driver.
- The need to address social and environmental justice questions and potential issues.



Project Approach

The Steering Committee suggests the following phased approach based on discussion and September 2020 survey results. However, the project team can discuss tasks/order and revamp approach with the steering committee if desired.

Phase 1 – Stormwater capture and use

Capitalize on the efforts of WRAP Action 2.3.3 and [WRF Project 4841](#) *Assessing the State of Knowledge and Research Needs for Stormwater Harvesting* to develop a research strategy for stormwater reuse. Tasks will be dictated by the 4841 project. The final report is expected to be released in early/mid 2023. (MILESTONE/DELIVERABLE)

Phase 2 – Municipal Reuse for Drinking Water (Potable Reuse)

Task 1: Identify Gaps/Challenges

- Hold a 4 hour Research Needs Workshop at the 37th Annual WaterReuse Symposium. Start by framing the state of the science by topic (source water, monitoring, treatment, implementation) through presentations from leading US experts (MILESTONE/DELIVERABLE – Attachment B 3/6/22 PPT). Then participants gather in ~10 person breakout sessions led by facilitators to develop project concepts in the topic they chose.
- SUMMARY:
The research road-mapping workshop was a huge success, bringing together over 75 water reuse experts and practitioners to collaboratively develop a comprehensive roadmap for future reuse research! The two-part four-hour workshop resulted in 53 project concepts and was followed by a prioritization [reuse survey](#) that resulted in project rankings and 20 additional new project ideas. Highly ranked projects include better characterization of source water from industrial discharges, reimagining advanced water treatment trains, opportunities to use AI or machine learning in potable reuse, and solutions for regional approaches to brine management. The Water Research Foundation will be incorporating over 30 of the total 73 projects into research planning discussions for the upcoming and all project ideas will be used in shaping the final deliverable for WRAP Action [Item 7.2: Develop a Coordinated National Research Strategy](#).

Task 2: Rank Needs & Develop Research Projects

- The resulting 53 project concepts were put into a [reuse survey](#) so that workshop participants, Symposium attendees, and reuse practitioners can rank the project concept in order to importance. The survey results will be released and posted as MILESTONE/DELIVERABLE in May

2022. Top ranked projects are being fed into the [2022 WRF Research Priority Program](#), and several will likely be developed into RFPs and be released this summer.

Task 3: Develop Research Strategy

- a) Incorporate research strategy with needs and recommendations for how to address them (stakeholders, potential partners/funding agencies, etc) in main final report.

Phase 3 – Agricultural reuse

Capitalize on the efforts of WRAP Action 1.6, 2.12, 5.1 and the following WRF projects completed or underway:

- [WRF 4775](#)
- [WRF Project 4841](#)
- [WRF 4829](#)
- [WRF 4956](#)

Use [WRF 4956](#) *Addressing Impediments and Incentives for Agricultural Reuse* to develop a research strategy for agricultural reuse. Tasks will be largely dictated by the 4956 project. The final report is expected to be released in early/mid 2024. (MILESTONE/DELIVERABLE)

Phase 4 – Nonpotable reuse (on-site residential and commercial reuse, urban reuse for irrigation, etc.)

To be determined. Incorporate other WRAP Actions and include in main final report.

Phase 5 – Environmental reuse (saltwater intrusion, environmental restoration, etc.)

To be determined. Incorporate other WRAP Actions and include in main final report.

Phase 6 – Industrial reuse (industrial oil/gas, industrial process and cooling, etc.)

To be determined. Incorporate other WRAP Actions (including Action 4.2) and include in main final report.

Reporting and Deliverables

- Per above, each Phase (i.e., 1 – 6) will have an individual chapter or separate report that provides a **Research Strategy Framework** (regionally based where applicable).
- Report A: Building upon Phases 1 through 6, develop a report addressing **National Research Priorities for Water Reuse**. This document shall:
 - identify the highest priorities among regions and among reuse type,
 - identify priorities that would benefit the most regions or result in the most significant volumetric contributions or highest percent increase to reuse
 - identify cost-effective or opportunities for reuse that provide multiple benefits and or address other critical issues to communities such as water supply resiliency, climate resiliency and adaptation, regulatory requirements, social and environmental justice, increased water quality, and greater protection of the environment.
 - integrate the national research priorities and recommendations for implementation.
- Other: Virtual recorded workshops/webcasts, regionally when appropriate; National Presentation at WaterReuse Symposium