



Office of Research and Development

# SAFE AND SUSTAINABLE WATER RESOURCES RESEARCH PROGRAM



## SSWR Overview for BoSC Meeting

April 23, 2019





# **SSWR Vision**

**SSWR's commitment to robust research and scientific analyses will support innovative scientific and technological solutions that ensure adequate supplies of clean water to protect people's health and livelihood, to protect and restore watersheds and aquatic ecosystems, and to strengthen the economy.**



## ORD StRAP Basics

- Provides the foundation for ORD research to meet the goals outlined in the ORD Strategic Plan and the EPA Strategic Plan.
- Specific water research activities are required or authorized under various provisions of the Clean Water Act and Safe Drinking Water Act.
- Developed in consultation with EPA program offices and regions, partners and stakeholders.
- Implemented by ORD's laboratories and centers.
- Planning and progress reviewed by the Board of Scientific Counselors







# Partner and Stakeholder Engagement

**EPA** Office of Water, Regions, other offices

**States** Environmental Council of the States (ECOS)  
Environmental Research Institute of the States (ERIS)

**Tribes** Tribal Science Council  
National Tribal Water Council, other tribal organizations

**Federal** White House National Science and Technology Council's  
Subcommittee on Water Availability and Quality (SWAQ)

**International** Global Water Research Coalition  
MOUs and other mechanisms (Australia, Singapore, China, others)

**Multi-sector** Academia, NGOs, Industry, Agriculture, Small Communities





## Connecting SSWR Research to States' Needs: 2018 ECOS/ERIS Survey

### Nutrients and HABs

State Need	Research Area(s)
HABs (mitigation, recreational criteria, etc.)	<ul style="list-style-type: none"><li>• Assessment and Management of HABs</li><li>• Nutrient Reduction Strategies and Assessment</li></ul>
<b>Nutrients and Nonpoint Source Pollution</b> <ul style="list-style-type: none"><li>• Implementation of TMDLs for phosphorus and nitrogen on lakes and of WQBELs for phosphorus at wastewater treatment plants</li><li>• Control of nutrients from agriculture, stormwater runoff, and poorly maintained/failing septic systems</li><li>• TMDLs, control methods for phosphorus and nitrogen</li><li>• Prioritizing watershed best management practice efforts</li></ul>	<ul style="list-style-type: none"><li>• Science to Support Nutrient-Related Water Quality Goals</li><li>• Nutrient Reduction Strategies and Assessment</li><li>• Integrated Stormwater Management</li></ul>
Protective, effects-based numeric nutrient criteria for rivers and streams.	<ul style="list-style-type: none"><li>• Science to Support Nutrient-Related Water Quality Goals</li></ul>
Advanced Monitoring and Sensors for Pollutants Challenges	<ul style="list-style-type: none"><li>• Assessment, Monitoring, and Management of Aquatic Resources</li><li>• Assessment and Management of HABs</li><li>• Nutrient Reduction Strategies and Assessment</li></ul>



## Connecting SSWR Research to States' Needs: ECOS/ERIS Media Meeting

State Need	Research Area(s)
Research at the groundwater-surface water interface (OK)	<ul style="list-style-type: none"> <li>Assessment, Monitoring, and Management of Aquatic Resources</li> </ul>
HABs (MO) <ul style="list-style-type: none"> <li>Ecological endpoints</li> <li>Gulf Hypoxia research</li> <li>WQS criteria validation</li> <li>Using satellite images for bloom prediction</li> <li>HAB method development and validation</li> <li>HAB risk assessment based on lake attributes (WI)</li> </ul>	<ul style="list-style-type: none"> <li>Assessment and Management of HABs</li> <li>Nutrient Reduction Strategies and Assessment</li> </ul>
Water reuse (CO, AZ)	<ul style="list-style-type: none"> <li>Wastewater/Water Reuse</li> </ul>
Wastewater treatment plants and landfills (MI)	<ul style="list-style-type: none"> <li>Wastewater/Water Reuse</li> <li>Per- and Polyfluoroalkyl Substances (PFAS)</li> </ul>
Removing (emerging) contaminants from direct potable reuse (TN, OK)	<ul style="list-style-type: none"> <li>Wastewater/Water Reuse (<i>biological contaminants focus</i>)</li> </ul>
More bioassessment tools for estuarine/marine waters - especially since EPA has an emphasis on downstream water quality (FL)	<ul style="list-style-type: none"> <li>Assessment, Monitoring, and Management of Aquatic Resources</li> <li>Science to Support Nutrient-Related Water Quality Goals</li> </ul>
Tools to discriminate nutrient sources—bring down costs/accuracy (NE)	<ul style="list-style-type: none"> <li>Nutrient Reduction Strategies and Assessment</li> </ul>
Waste management or reuse options for the residuals from water treatment, whether it be from produced water or other, where there is the possibility to generate voluminous solids, highly concentrated water, that possibly contain norm and tenorm (OK)	<ul style="list-style-type: none"> <li>Wastewater/Water Reuse</li> <li>Integrated Stormwater Management</li> <li>Per- and Polyfluoroalkyl Substances (PFAS)</li> </ul>



## Connecting SSWR Research to States' Needs: 2018 ECOS/ERIS Survey

### Emerging Contaminants

State Need	Research Area(s)
Manage new chemicals of emerging concern and existing chemicals. <ul style="list-style-type: none"><li>• Health effects, analytical methods, and treatment</li></ul>	<ul style="list-style-type: none"><li>• Per- and Polyfluoroalkyl Substances (PFAS)</li><li>• Drinking Water/Distribution Systems</li><li>• Wastewater/Water Reuse</li><li>• Human Health and Aquatic Life Criteria</li></ul>
Adapt and respond to emergencies. <ul style="list-style-type: none"><li>• Contaminated surface water, groundwater, and drinking water</li></ul>	<ul style="list-style-type: none"><li>• Technical Support</li></ul>
More info for PFAS, surface water standards, fish consumption, and biosolids advisory levels.	<ul style="list-style-type: none"><li>• Per- and Polyfluoroalkyl Substances (PFAS)</li><li>• Drinking Water/Distribution Systems</li><li>• Wastewater/Water Reuse</li></ul>



## Connecting SSWR Research to Tribal Needs: National Tribal Water Council, Spring 2018

Tribal Need	Research Area(s)
Predictive modeling capability for HABs	<ul style="list-style-type: none"> <li>Assessment and Management of HABs</li> </ul>
Develop guidance for addressing drinking water and wastewater home-based technologies for rural/tribal communities	<ul style="list-style-type: none"> <li>Drinking Water/Distribution Systems</li> <li>Wastewater/Water Reuse</li> <li>Technical Support</li> </ul>
Develop guidance for water system operators on corrosion control	<ul style="list-style-type: none"> <li>Drinking Water/Distribution Systems</li> <li>Technical Support</li> </ul>
Dependable, affordable continuous water quality monitoring equipment.	<ul style="list-style-type: none"> <li>Assessment, Monitoring, and Management of Aquatic Resources</li> <li>Assessment and Management of HABs</li> <li>Nutrient Reduction Strategies and Assessment</li> <li>Drinking Water/ Distribution Systems</li> <li>Wastewater/Water Reuse</li> <li>Integrated Stormwater Management</li> <li>Technical Support</li> </ul>
<i>Develop ecologically-based criteria for sulfate and identify treatment technologies</i>	<ul style="list-style-type: none"> <li><i>Human Health and Aquatic Life Criteria</i></li> </ul>
Nutrient reduction strategies; agriculture impacts; CAFOs	<ul style="list-style-type: none"> <li>Nutrient Reduction Strategies and Assessment</li> </ul>
Microbial source tracking; reducing <i>E. coli</i>	<ul style="list-style-type: none"> <li>Human Health and Aquatic Life Criteria</li> </ul>



# Research Objectives



**Improve Prediction and Early Detection of Contaminants**



**Assess Potential Impacts**



**Develop and Evaluate Approaches for Prevention and Mitigation**



**Translate and Communicate Research**



# Overarching Research Topics

## SAFE AND SUSTAINABLE WATER RESOURCES RESEARCH PROGRAM

Clean Water Act

Safe Drinking Water Act



Watersheds



Nutrients and Harmful Algal Blooms



Water Treatment and Infrastructure







# Watersheds

## Rick Greene - Gulf Breeze, FL

### Research Area 1

#### Assessment, Monitoring, and Management of Aquatic Resources

Nationally consistent and scientifically defensible assessments of U.S. waters to implement the National Aquatic Resource Surveys (NARS).

### Research Area 2

#### Improved Aquatic Resource Mapping

Methodologies, tools, and datasets for aquatic resource mapping of waters of the United States.

### Research Area 3

#### Human Health and Aquatic Life Criteria

Science to support EPA's Office of Water (OW) to assist regions, states, and tribes with new or revised water quality criteria and their implementation, including support to protect human health and aquatic life from pollutants in surface water.





## Research Area I: Assessment, Monitoring, & Management of Aquatic Resources

## Outputs

	Title	Description
<b>Output 1</b>	Science to support NARS survey design, indicator development and assessment benchmarks, methods development, and data tools.	<ul style="list-style-type: none"> <li>• Technical support and tools to implement NARS.</li> </ul>
<b>Output 2</b>	Extended applications of NARS data and approaches to support priority setting and management actions.	<ul style="list-style-type: none"> <li>• Analytical approaches and new tools to leverage survey data for condition assessment, trends analysis, stressor identification, and causal analysis.</li> </ul>
<b>Output 3</b>	Tools, indicators, and information to inform water quality goals, assess biological condition, and support effective management of diverse water bodies.	<ul style="list-style-type: none"> <li>• Tools to advance integrated watershed assessments, establish attainable biological targets, and evaluate recovery potential.</li> </ul>
<b>Output 4</b>	Methods, models, and tools to evaluate the potential health effects from exposure to micro/nanoplastics.	<ul style="list-style-type: none"> <li>• Analytical methods for micro/nanoplastics in water and tools to assess potential adverse health outcomes from exposure.</li> </ul>
<b>Output 5</b>	Water quality models and economic analyses to support science-based water quality decisions.	<ul style="list-style-type: none"> <li>• Technical support for water quality modeling and applications for linking water quality and economic models.</li> </ul>
<b>Output 6</b>	Research support for the San Juan Watershed Program	<ul style="list-style-type: none"> <li>• Technical support and tools for monitoring and modeling sources, fate, and transport of metals and other pollutants in the Animas-San Juan watershed.</li> </ul>



## Research Area 2: Improved Aquatic Resource Mapping

## Outputs

### Watersheds

	Title	Program/Region/State/Tribal Needs
Output 7	Transferrable methodologies, tools, and datasets to improve the accuracy and application of geospatially-explicit aquatic resource data.	<ul style="list-style-type: none"><li>• Tools for aquatic resource mapping of waters of the United States.</li></ul>





## Research Area 3: Human Health and Aquatic Life Criteria

## Outputs

	Title	Description
Output 8	Data and innovative tools to advance public health protection from microbial contaminants in surface water.	<ul style="list-style-type: none"><li>Analytical tools for pathogens, fecal indicators and sources, including antimicrobial resistance, and science supporting recreational water quality criteria.</li></ul>
Output 9	Data and innovative tools to advance public health from consumption of chemical contaminants in surface waters and aquatic organisms.	<ul style="list-style-type: none"><li>Technical support and tools to address data gaps and modeling challenges to developing bioaccumulation factors for metals and other contaminants for human health criteria.</li></ul>
Output 10	Science to advance the methodology for deriving water quality criteria to protect aquatic life from toxic chemicals.	<ul style="list-style-type: none"><li>Scientific and technical support to update the 1985 Aquatic Life Guidelines.</li><li>Developing next generation toxicological tools for new and emerging contaminants, including mixtures, for aquatic life guidelines.</li></ul>



# Nutrients and Harmful Algal Blooms

## Anne Rea – RTP, NC

### Research Area 1

#### Assessment and Management of HABs

Provide stakeholders and decision-makers at the national, regional, state, and local levels with scientific information and tools to more effectively assess and manage HABs and associated toxicity events.

### Research Area 2

#### Science to Support Nutrient-Related Water Quality Goals

Advance the science to inform decisions related to nutrient and co-pollutant water quality goals of program offices, regions, states, and tribes.

### Research Area 3

#### Assessment and Management of Nutrients

Support to plan, implement, and track the effectiveness of nutrient reduction strategies at multiple scales, including watersheds draining to receiving waters potentially affected by HABs or other nutrient-related water quality issues.









**Research Area I:  
Assessment and Management of Harmful  
Algal Blooms**

**Outputs**

	<b>Title</b>	<b>Description</b>
<b>Output 11</b>	Data and tools to assess human and environmental adverse health outcomes from exposure to HABs and associated toxins.	<ul style="list-style-type: none"><li>• Epidemiological and toxicological data on existing and emerging cyanotoxins.</li></ul>
<b>Output 12</b>	Information for preventing, treating and managing HABs and their impacts in water bodies, ambient water, and drinking water.	<ul style="list-style-type: none"><li>• Research and evaluation of management actions in watersheds, including economic analyses.</li></ul>
<b>Output 13</b>	Tools for HABs risk characterization and assessment.	<ul style="list-style-type: none"><li>• Tools for predicting, characterizing and monitoring HABs.</li></ul>



## Research Area 2: Science to Support Nutrient-Related Water Quality Goals

## Outputs

	Title	Description
Output 14	Research for characterizing nutrient-related impacts across multiple spatial scales.	<ul style="list-style-type: none"><li>• Scientific support for developing numeric nutrient criteria.</li><li>• Methods to determine nutrient-related impacts in watersheds and waterbodies.</li></ul>
Output 15	Trajectories of aquatic ecosystem responses to and recovery from nutrient pollution.	<ul style="list-style-type: none"><li>• Information on waterbody recovery rates from nutrient pollution.</li></ul>
Output 16	Scientific approaches for identifying which watersheds and water bodies may most efficiently attain water quality goals.	<ul style="list-style-type: none"><li>• Assessment of nutrient-related impacts on aquatic life.</li><li>• Approaches to identify watershed and water bodies that will most effectively respond to restoration and recovery efforts.</li></ul>



**Research Area 3:  
Assessment and Management of Nutrients**

**Outputs**

	<b>Title</b>	<b>Description</b>
<b>Output 17</b>	Tools, technologies, and best practices to predict, monitor, and reduce nutrients in surface water and groundwater. (Application of state-of-the-science for nutrient reduction strategies)	<ul style="list-style-type: none"><li>• Scientific support to determine which practices, in which combinations, in which locations are best suited to reduce nutrient loadings to ambient water.</li></ul>
<b>Output 18</b>	Information for assessing the effectiveness of restoration and conservation systems and practices. (Effectiveness monitoring)	<ul style="list-style-type: none"><li>• Program designs for monitoring and tracking nutrient management activities, including low-cost sensor technology.</li></ul>
<b>Output 19</b>	Best practices for integrated nutrient reduction programs. (Whole system integrated nutrient science, engineering, economics, and stakeholder engagement)	<ul style="list-style-type: none"><li>• Social science applications to address water quality.</li><li>• Information on water body recovery rates from nutrient pollution.</li></ul>



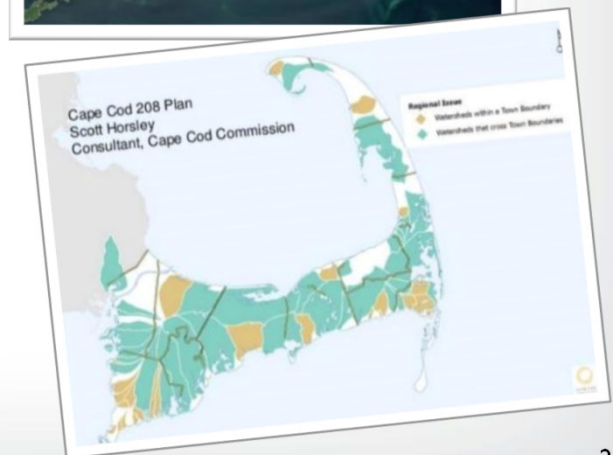
## Translational Science Pilot: Managing Non-Point Source Nitrogen on Cape Cod, MA

Approximately 34 watersheds on Cape Cod, MA with Total Maximum Daily Loads for nitrogen not currently being met.

- The State of Massachusetts, the Cape Code Commission, other organizations and communities are working to address loading limits.
- Sewering is prohibitively expensive and does not address legacy nutrients in surface and ground water.

**Solution-driven research: ORD/SSWR pilot project.**

- Integrating social and ecological sciences.
- Engaging partners and stakeholders to assess the effectiveness of alternative solutions.
- Supporting communities to weigh trade-offs and benefits of innovative watershed-based solutions.
- Designing approaches that are customizable and transferable both regionally and nationally.









# Water Treatment and Infrastructure

## Chris Impellitteri – Cincinnati, OH

### Research Area 1 **Drinking Water/Distribution Systems**

Provide essential results and tools to our customers for managing existing and future drinking water needs. Specifically, it focuses on areas of recent concern that require novel solutions.

### Research Area 2 **Per- and Polyfluoroalkyl Substances (PFAS)**

Robust analytical methods for analyzing PFAS in water, solids, and tissue samples, and a centralized website for treatment and pretreatment recommendations for wastewater and reuse.

### Research Area 3 **Wastewater/Water Reuse**

Guidance on new and existing treatment technologies and analytical methods for emerging contaminants and contaminant risks.

### Research Area 4 **Integrated Stormwater Management**

Integrated aspects of green/gray infrastructure and stormwater flow control to help states, municipalities, and utilities reduce the number of combined sewer overflows.

### Research Area 5 **Technical Support**

Provide a means for rapid response to specific, unplanned program office, state, tribe, and community research needs concerning high-priority issues.





## Research Area I: Drinking Water/Distribution Systems

## Outputs

	Title	Description
Output 20	Resources and tools for characterizing and mitigating lead in drinking water distribution systems and premise plumbing.	<ul style="list-style-type: none"><li>• Technical support for revisions to the Lead and Copper rule.</li><li>• Resources for states to minimize lead exposure.</li></ul>
Output 21	Best practices, tools and information for assessing and controlling pathogens and biostability, managing disinfectant residuals, and minimizing disinfection by-products in drinking water systems.	<ul style="list-style-type: none"><li>• Technical support for 6-year reviews on DBPs and future decisions on the Unregulated Contaminant Monitoring Rule.</li><li>• Resources for small systems for optimizing disinfection strategies.</li></ul>
Output 22	Analytical methods, occurrence, health effects, and treatment assessments for emerging contaminants.	<ul style="list-style-type: none"><li>• Treatment options and technical support for future regulatory determinations and health advisories.</li></ul>
Output 23	Resources and tools towards a systems approach for maintaining drinking water infrastructure performance and integrity.	<ul style="list-style-type: none"><li>• Technical support for states and small systems for maintaining and improving drinking water infrastructure.</li></ul>



## Research Area 2: Per- and Poly-Fluorinated Alkyl Substances (PFAS)

## Outputs

	Title	Program/Region/State/Tribal Needs
Output 24	Validated analytical methods for PFAS in environmental samples.	<ul style="list-style-type: none"><li>• Robust analytical methods for analyzing PFAS in water, solid, and tissue samples.</li></ul>
Output 25	Treatment technologies and processes for removing PFAS from water.	<ul style="list-style-type: none"><li>• Centralized website for treatment and pre-treatment recommendations for wastewater and water reuse treatment strategies.</li></ul>
Output 26	Characterization of PFAS sources and remediation options for wastewater, biosolids, and landfill leachates.	<ul style="list-style-type: none"><li>• Characterization of PFAS in biosolids, wastewater, and landfill leachates with an emphasis on pre-treatment strategies for minimizing PFAS contamination in water resources.</li></ul>



	<b>Title</b>	<b>Description</b>
<b>Output 27</b>	Analytical methods, exposure and effects assessment processes, and tools for wastewater and fit-for-purpose water reuse.	<ul style="list-style-type: none"><li>• Scientific data to support risk assessments of wastewater for discharge and for reuse. Technical support for developing or optimizing whole effluent toxicity tests.</li><li>• Advancement of new methods (bioassays) for monitoring effluents.</li></ul>
<b>Output 28</b>	Assessment of treatment strategies and technologies for wastewater and fit-for-purpose water reuse.	<ul style="list-style-type: none"><li>• Technical evaluations for states and program offices on water reuse treatment technologies</li><li>• Technologies and treatment targets for fit-for-purpose reuse.</li></ul>



## Research Area 4 & 5: Integrated Stormwater Management & Technical Support

## Outputs

		Title	Description
Area 4	Output 29	Integrated guidance for planning, implementing, and monitoring stormwater management practices.	<ul style="list-style-type: none"><li>• Support for states/regions to implement the most effective and economical green and gray infrastructure combinations for managing CSOs.</li></ul>
	Output 30	Integrated stormwater management as a resource for enhanced recharge, reuse, and ecological functions and benefits.	<ul style="list-style-type: none"><li>• Research results on stormwater capture and water quality for augmenting safe water supplies.</li></ul>
Area 5	Output 31	Technical support for water treatment, analytical methods, and risk assessments.	<ul style="list-style-type: none"><li>• Application of research results and technical expertise to support state/region needs for site-specific environmental challenges.</li></ul>



# National Priorities and STAR Grants

RFA  
Aug-Oct  
2018

**Methods to Analyze & Treat PFAS in Solid Waste, Landfills, Wastewater/Leachates, Soils, & Groundwater**  
[Overview](#)

RFA  
May-Jun  
2018

**Per- and Polyfluoroalkyl Substances (PFAS)**  
[Overview](#)

2018 -  
2021

**Transdisciplinary Research into Detecting and Controlling Lead in Drinking Water**  
[Two grants awarded](#) (States: VA, LA, NC, TX, IA)

2018 -  
2020

**Freshwater Harmful Algal Blooms**  
[Two grants awarded](#) (States: OH, IA)

2016 -  
2021

**National Center for Sustainable Water Infrastructure Modeling Research**  
[One grant awarded](#) (States: TX, NC, UT, CO)

2016 -  
2020

**NP: Life Cycle Costs of Water Infrastructure Alternatives**  
[Two grants awarded](#) (States: VA, CO, MD, UT, KS, CA)



# National Priorities and STAR Grants

**2016 - 2019** **Impacts of Water Conservation on Water Quality in Premise Plumbing and Distribution Systems**  
[Two grants awarded](#) (States: PA, IN, CO, MI, CA, LA)

**2016 - 2019** **Water Quality Benefits**  
[Six grants awarded](#) (States: NC, IA, MA, MI, NH, NC, CT, MD, MN, TN, WI, VA)

**2015 - 2020** **Human and Ecological Health Impacts Associated with Water Reuse and Conservation Practices**  
[Five grants awarded](#) (States: NV, CA, UT, IL, VA, NY, MD, D.C.)

**2014 - 2017** **National Centers for Innovation in Small Drinking Water Systems**  
[Two grants awarded](#) (States: MA, CO, TX, FL, IL, NE, FL, AL, NH, TX)

**2014 - 2017** **Systems-Based Strategies to Improve the Nation's Ability to Plan & Respond to Water Scarcity & Drought**  
[Four grants awarded](#) (States: SC, UT, CA, CO)

**2013 - 2018** **Centers for Water Research on National Priorities Related to Systems View of Nutrient Management**  
[Four grants awarded](#) (States: NY, VA, CA, MI, WA, MD, FL, TX, CO)







# Communication and Outreach Highlights

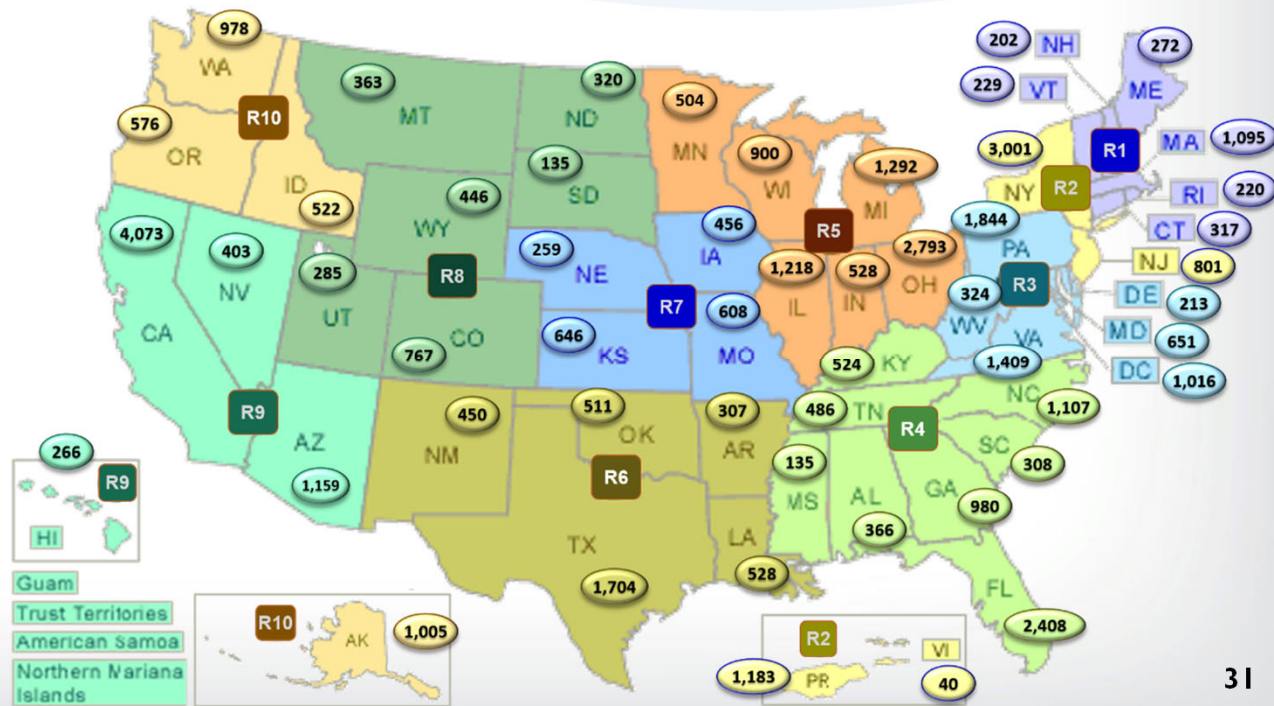
- ❖ [ORD-SSWR/OW/ASDWA Small Systems Annual Workshop](#)
- ❖ [ORD-SSWR/OW Small Systems Monthly Webinar Series](#) →
- ❖ [SSWR Water Research Program Webinar Series](#)
- ❖ [EPA Tools and Resources Webinar Series](#)
- ❖ [Science Matters Biweekly Newsletter](#)
- ❖ [Fact Sheets](#)
- ❖ [Videos](#)
- ❖ [Publications](#)
- ❖ [Website](#)

January 2015 – March 2019

- 44,974 Attendees
- 27,682 Continuing Education Credits

## Affiliation Percentages

13%	Federal Gov't
43%	State Gov't
13%	Local Gov't
1%	Tribal Gov't/Nation
8%	Utility (Public/Private)
1%	Military
10%	Consultant/Tech Assist
4%	Private Sector
3%	Academia/Education
2%	NGO/Association
1%	Other



# Questions?

