Appendix B: Federal Partner Profiles

NATIONAL WATER REUSE
ACTION PLAN
DRAFT

Appendix B: Compilation of Federal Partner Profiles

Appendix B provides a selection of profiles from federal partners involved in the development of the draft Action Plan. Each profile is intended to illustrate the context, role, and opportunities the agency has to champion reuse within their mission area. This compilation serves to describe the individual and collective efforts across the federal partners. The descriptions below are intended to be high level and illustrative, not comprehensive or representative of each agency's entire portfolio that may be applicable to water reuse or nexus opportunities. The following federal partner profiles are provided in this appendix:

- U.S. Bureau of Reclamation
- U.S. Centers for Disease Control and Prevention
- U.S. Department of Defense
- U.S. Department of Energy
- U.S. Environmental Protection Agency
- U.S. Food and Drug Administration
- Agricultural Research Service
- National Institute of Food and Agriculture
- Natural Resources Conservation Service
- U.S. Geological Survey

Water Reuse Partner Profile

U.S. Bureau of Reclamation

Washington, D.C./Denver, Colorado

Agency Mission

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Context and Applicability to Water Reuse

Reclamation provides grant funding and technical expertise for water reuse research and project development and implementation.

Explicit Roles and Actions in Water Reuse

Desalination and Water Purification Research (DWPR) Program

The DWPR Program is authorized under the Water Desalination Act of 1996 (P.L. 104-298), amended in 2016 by the Water Infrastructure Improvements for the Nation (WIIN) Act. The program provides financial assistance for desalination and water treatment research and development leading to improved technologies for converting unusable water sources into useable water supplies. Water sources include, but are not limited to, sea water, brackish groundwater, municipal wastewater, and produced waters from oil and gas activities. The DWPR Program released two competitive funding opportunity announcements in fiscal year 2019: the first closed in December 2018 and the second opened in April 2019. The first invited research projects at the laboratory and pilot scale. The second invites proposals to pilot projects to test innovative and disruptive technologies poised for commercialization, featuring an application process streamlined for small businesses and entrepreneurs. Both funding opportunities seek solutions that address water reuse objectives identified by the National Research Council's 2012 report *Water Reuse: Potential for Expanding the Nation's Water Supply Through Reuse of Municipal Wastewater*.

WaterSMART Title XVI Water Reclamation and Reuse Program

Through the Title XVI Program, Reclamation provides funding for planning, design, and construction of water reclamation and reuse projects in partnership with local entities in the West. Title XVI projects reclaim and reuse municipal, industrial, domestic, and agricultural wastewater and impaired ground and surface water. The Title XVI Program provides funding on a year-by-year basis through a competitive selection process, with a maximum federal cost share of 25 percent of total project costs, up to $20 million, unless Congress specifies otherwise. Reclamation has released three funding opportunity announcements in fiscal year 2019—one for congressionally authorized Title XVI projects, one for reuse projects that are eligible under the WIIN Act amendments to the Title XVI Program, and one for water reuse research through the Title XVI Program.

WaterSMART Drought Response Program

In 2015, Reclamation reformulated its existing drought program to improve its ability to help stakeholders build resilience to drought in advance of a crisis. Through the Drought Response Program, Reclamation partners with states, tribes, and local governments for drought contingency planning and actions that build long-term resiliency to drought—including projects that increase flexibility for water managers through system modifications and improvements, development of alternative water supplies, and other projects to

mitigate the impacts of future drought. Water desalination or recycling projects with a total estimated project cost of less than $5 million are eligible for funding. Reclamation allocates program funding annually through Funding Opportunity Announcements. Projects are chosen through a competitive process and a 50 percent non-federal cost share contribution is required.

Examples of Partners and Stakeholders

- States.
- Indian tribes or tribal organizations.
- Municipalities.
- Water districts.
- Wastewater districts.
- Rural water districts.
- Regional or local authorities.
- Individuals/entrepreneurs.
- Institutions of higher education.
- For-profit organizations.
- Nonprofit organizations.
- Federally funded research and development centers.
- United States–Mexico binational research foundations and interuniversity research programs.

Water Reuse Federal Partner Profile

U.S. Centers for Disease Control and Prevention (CDC)

Atlanta, Georgia

Agency Mission

The CDC's mission is "to serve as the national focus for developing and applying disease prevention and control, environmental health, and health promotion and health education activities designed to improve the health of the people of the United States" (mission/function statement). With respect to achieving clean and safe water, the CDC strives to protect people's health from environmental hazards that can be present in the water we drink and use in diverse ways to sustain our health, productivity and well-being.

Context and Applicability to Water Reuse

The CDC strives to protect public health through non-regulatory actions that decrease environmental threats to water systems and may directly and indirectly influence water reuse. Non-regulatory actions that CDC has undertaken to protect public health from waterborne diseases and outbreaks include:

- Conducting applied scientific research for risk assessment:
  - National Center for Environmental Health (NCEH) Safe Water Program.
  - Waterborne Disease Prevention Branch (WDPB).
- Developing better laboratory detection and sampling methods.
- Investigating the causes and sources of waterborne disease and outbreaks.
- Tracking waterborne diseases nationally.
- Developing partnerships with state, local, and tribal public health organizations.
- Providing technical assistance and funding to state, local, territorial, and tribal public health organizations.
- Promoting safe water guidance through public communication and education.

Explicit Roles and Actions in Water Reuse

Science and Research of Contaminants of Emerging Concern

- The CDC develops reports, recommendations, and other studies for investigation and prevention of waterborne disease outbreaks, including:
  - An A–Z Index of water-related health topics and data.
  - *Morbidity and Mortality Weekly Reports* (MMWRs) containing publications on emerging infectious diseases and outbreak surveillance. For example:
    - *Lead in Drinking Water and Human Blood Lead Levels in the United States*.
    - *Surveillance of Waterborne Disease Outbreaks Association with Drinking Water—United States, 2013–2014*.
    - *Waterborne Disease Outbreaks Associated with Environmental and Undetermined Exposures to Water—United States, 2013-2014*.

- The CDC's National Environmental Public Health Tracking Network provides public access to climate change, community design, drought, drinking water, populations and vulnerabilities, and toxic substance release data.
- The CDC is developing improved laboratory methods for sampling, testing, and monitoring water quality through the Division of Foodborne, Waterborne, and Environmental Diseases (DFWED) Waterborne Disease Prevention Branch Environmental Microbiology Laboratory. The CDC NCEH Environmental Health Laboratory conducts laboratory testing of clinical specimens to enable detection, diagnosis, treatment and prevention of diseases resulting from exposure to environmental chemicals and toxins.

Building National Surveillance Capacity

- The CDC operates the National Outbreak Reporting System (NORS) and national Waterborne Disease and Outbreak Surveillance System (WBDOSS), which collect data on waterborne disease and outbreaks in the United States. These efforts provide important information on how germs, harmful chemicals, or toxins spread, and which types of water are linked to people getting sick.

Collaboration and Partnerships

- The CDC works with EPA and other federal and non-governmental partners (e.g., AWWA) to provide guidance on water-related best practices, policies and research priorities.
- The CDC provides water-related support to state health departments and works with national partners (e.g., ASTHO, CSTE, and NACCHO) that represent state and local partners on water-related issues.
- The CDC's Safe Water Program and Waterborne Disease Prevention Branch supports state, local, and tribal public health organizations in planning, implementation, and evaluation of programs promoting water safety. For example:
    - During a harmful algal bloom (HAB) in Lake Erie, the CDC provided health officials from Toledo, Ohio, with tools and educational materials to support their response to HABs and protect nearly 500,000 citizens.
    - The CDC has worked with Iowa's Cerro Gordo County Department of Public Health to protect the health of residents who may be exposed to arsenic in private well water.
- The CDC's Safe Water for Community Health (Safe WATCH) cooperative agreement funds local health departments to identify and close environmental health service gaps in their programs.

Risk Communication and Information Dissemination

- The CDC develops and improves access to water-related health and prevention information through expansion of the content and resources on the Healthy Water website.
- The CDC promotes national drinking-water-related observances, celebrations, and awareness days to educate the public about water-related issues.
- The CDC assists health departments respond to natural disasters and other emergencies that disrupt water service and create environmental hazards and infectious disease risks
- The CDC assists health departments investigate water related disease outbreaks and exposures to water-related contaminants.
- The CDC has developed a Drinking Water Advisory Communication Toolbox, which provides information on how to plan for, develop, implement, and evaluate communication activities with the public and stakeholders during drinking water notifications and advisories. The toolbox complements the EPA's Revised Public Notification Handbook.

Examples of Partners and Stakeholders

- State, local, territorial, and tribal health departments.
- Council of State and Territorial Epidemiologists.
- National Environmental Health Association.
- National Network of Public Health Institutes.
- Association of Public Health Laboratories.
- Association of State and Territorial Health Officials.
- National Association of County and City Health Officials.
- The Environmental Protection Agency.
- American Water Works Association.
- Association of State Drinking Water Administrators.

Water Reuse Federal Partner Profile

U.S. Department of Defense (DoD)

Washington, D.C.

Agency Mission

The Department of Defense provides the military forces needed to deter war and ensure our nation's security.

Context and Applicability to Water Reuse

Water reuse intersects with the DoD mission in key areas such as the establishment of resilient water supplies at installations and the reduction of water resupply requirements for personnel operating in expeditionary settings. Through the US Army Corps of Engineers, the DoD also supports water resource planning, development, and management, as well as the development and management of unified facilities criteria. The DoD executes its mission under the National Defense Authorization Act, and civil works water resource activities of the Corps of Engineers are authorized under the Water Resources Development Act.

Examples of DoD activities that address water reuse include:

- Establishment of policies for resilient military facilities and operations
- Research and development of water reuse capabilities for military environments
- Development of standards and guidelines for the protection of health of military personnel and the environment
- Facilities engineering guidance for military construction
- Implementation of projects and acquisition of systems

Explicit Roles and Actions in Water Reuse

DoD Policies Relating to Water Reuse

- Department of Defense Directive 4705.01E Management of Land-Based Water Resources in Support of Contingency Operations establishes policy, assigns responsibilities, and prescribes procedures for management of land-based water resources in support of contingency operations to ensure inter-Service compatibility and interoperability of water support equipment.
- Army Regulation 700-136 Tactical Land-Based Water Resources Management sets policy, defines the Army role in tactical operations, and outlines responsibilities for tactical water support.
- Army Directive 2017-07 Energy and Water Security Policy, describes objectives for resilient water systems at fixed facilities.

DoD Health Standards Relating to Water Reuse

- TB MED 577/NAVMED P-5010-10/AFMAN 48-138_IPSanitary Control and Surveillance of Field Water Supplies. This publication provides general instructions and detailed technical guidance and recommendations for the sanitary control and surveillance of land-based field water supplies. It

provides water quality standards for deployed personnel, including standards and guidelines for gray water reuse.

Examples of DoD Research and Development Relating to Water Reuse

- Gray Water Recycling in Expeditionary Settings. Research and development organizations within the DoD have developed and tested various technologies for gray water recycling, integrated into containerized, deployable systems. The goal of these systems is to treat gray water from shower and laundry systems such that it can be safely and efficiently reused again in the shower and laundry facilities. This necessitates a high level of treatment similar to advanced treatment processes used for direct potable reuse. The small scale of these systems requires increased automation and multiple barriers of treatment to control health risk. Technologies investigated include biofiltration, membrane bioreactors, forward osmosis, reverse osmosis, advanced oxidation, and disinfection.
- Direct Potable Reuse. The US Army Engineer Research and Development Center has been developing and studying direct potable reuse capabilities for both expeditionary and fixed military facilities. These studies have assessed various treatment processes and frameworks, as well as methods for monitoring and validating water quality in military environments. It should be noted that direct potable reuse in expeditionary settings in not currently allowed, and these efforts are specific to research for those settings.
- Distributed/Decentralized Wastewater Reuse. The Environmental Security Technology Certification Program (ESTCP) has funded several demonstrations of innovative wastewater treatment systems with potential applications for distributed wastewater treatment and reuse applications at fixed facilities. These have included membrane bioreactors, microbial fuel cells, and membrane distillation processes. Many of these systems were developed under the Strategic Environmental Research and Development Program (SERDP)
- Integrated Building-Scale Water Conservation and Reuse. ESTCP has funded demonstrations of water conservation technologies and their integration with water reuse technologies to assess relative costs and benefits.

Examples of DoD Engineering Guidance Relating to Water Reuse

- UFC 4-214-03 Central Vehicle Wash Facilities. This manual provides a comprehensive reference source for planning, and designing a central vehicle wash facility (CVWF) and decentralized, net zero wash facilities.
- UFC 3-240-02 Domestic Wastewater Treatment. Includes stipulations for DoD facilities to implement water reuse when financially competitive to conventional discharge systems.
- UFC 3-240-13FN Industrial Water Treatment Operation and Maintenance
- UFC 1-200-02 High Performance and Sustainable Building Requirements
- Public Works Technical Bulletin 200-1-142. Applicable Guidelines for Water Reuse at Army Installations.
- Review of the Applicability of Published Water Reuse Guidelines for Contingency Operations. PHIP No. 39-06-0417. Army Public Health Center. April 2017.
- Water Reuse in Contingency Operations. US Army Public Health Command. March 2014.

Examples of Implementation and Acquisition Programs Relating to Water Reuse

- Energy Resilience and Conservation Investment Program (ERCIP). ERCIP is a subset of the Defense-Wide Mil Con Program specifically intended to fund projects that save energy and water (herein after "energy"), reduce DoD's energy costs, improve energy resilience/security, and contribute to mission assurance.

- Force Provider Shower Water Recycling System (SWRS). The SWRS is a containerized system that uses membrane filtration and supporting processes to convert gray water into high quality water that can be reused for showering and laundry. It is part of the Force Provider equipment series that provides an integrated deployable system for billeting, hygiene, dining, sanitation, and other services for up to 600 personnel. The SWRS is managed by the Army Product Manager for Force Sustainment Systems.

Examples of Partners and Stakeholders

- Regulatory agencies (State, Federal)
- Local communities
- Other federal agencies (DoE, EPA, BoR)
- Industry contractors
- Academic collaborators

Water Reuse Federal Partner Profile

U.S. Department of Energy (DOE)

Washington, D.C.

Agency Mission

The DOE's mission is "To ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions." The DOE has developed a robust set of activities that address challenges and opportunities related to the energy-water nexus.

Context and Applicability to Water Reuse

Energy and water systems are interconnected. Energy is required to extract, treat, and deliver water; water is used in multiple phases of energy production and electricity generation, from hydraulic fracturing and irrigating crops for biofuels to providing cooling water for thermoelectric power plants. Despite these interdependencies, energy and water systems have been historically developed and managed independently. The DOE focuses on the "energy-water nexus," aiming to advance holistic solutions that can improve resiliency, affordability, and environmental performance of energy and water systems concurrently.

The DOE has investments addressing energy efficiency and energy recovery in water reuse processes as well as water reuse in energy operations. In addition, at a systems level, the DOE's investments in desalination research and development can lead to a more diverse set of water resources ultimately being available for reuse.

Explicit Roles and Actions in Water Reuse

Water Security Grand Challenge

The Water Security Grand Challenge is a White-House-initiated, DOE-led framework to advance transformational technology and innovation to meet the global need for safe, secure, and affordable water. Using a coordinated suite of prize competitions, early-stage research and development, and other programs, the Grand Challenge has set the following goals for the United States to reach by 2030:

1. Launch desalination technologies that deliver cost-competitive clean water.
2. Transform the energy sector's produced water from a waste to a resource.
3. Achieve near-zero water impact for new thermoelectric power plants, and significantly lower freshwater use intensity within the existing fleet.
4. Double resource recovery from municipal wastewater.
5. Develop small, modular energy-water systems for urban, rural, tribal, national security, and disaster response settings.

Goals 2 and 4 have the most direct relevance to water reuse. Cost-effectively treating the produced waters that come up as a byproduct of inland oil and gas drilling could bring new supplies of water online and relieve stress on limited sources of freshwater in certain communities. Within goal 4, clean water is one of the resources being targeted for doubling, in addition to energy and nutrient recovery.

Indirectly, some of the technologies developed to advance cost-competitive desalination processes (goal 1) could add to the water resources that are ultimately available for water reuse. Additionally, strategies deployed to reduce freshwater use intensity within thermoelectric power plants (goal 3) could include increasing the number of cooling cycles for which water can be reused or reusing municipal wastewater for cooling purposes. Water reuse may also be a feature of different decentralized energy-water solutions developed through goal 5.

Some specific examples of water reuse activities launched by the DOE include:

- The Energy-Water Desalination Hub, a planned $100 million, five-year effort that will focus on early-stage research and development for energy-efficient and cost-competitive desalination technologies, and for treating non-traditional water sources for multiple end-use applications. A Funding Opportunity Announcement (FOA) for the Hub was released in December 2018, with selections expected in summer of 2019.
- Cost-shared research on produced water treatment and management from the DOE's Office of Fossil Energy, including a recently announced $5 million FOA to advance low-cost, efficient treatment technologies for produced water.
- Partnerships with the wastewater treatment sector to advance energy efficiency and energy recovery. These programs, which include the DOE's Sustainable Wastewater Infrastructure of the Future Accelerator, the Better Plants Program, Industrial Assessment Centers, and Combined Heat and Power Technical Assistance Partnerships, provide wastewater treatment plants with technical assistance, tools, and other resources to help them meet their energy efficiency and energy recovery goals.
- The DOE's Federal Energy Management Program helps federal agencies meet their energy and water efficiency goals. It has developed a series of tools and training resources focused on water efficiency and water reuse.
- The U.S.-Israel Cooperation in Energy and Water Technologies call for proposals issued by the DOE's Office of International Affairs (which closes in September, 2019) has a topic on testbeds for energy-smart water infrastructure, which can support water reuse.
- The DOE's Office of Fossil Energy issued the Crosscutting Research for Coal-Fueled Power Plants FOA in early 2019. It featured a topic on water management.

Examples of Partners and Stakeholders

- Water and wastewater utilities.
- Energy companies, including electric utilities, gas utilities, oil and gas production, and renewable energy providers.
- Water sector associations/organizations (e.g., WRF, WEF, WERF, NAWC, AWWA, NACWA, U.S. Water Alliance).
- Energy sector associations (e.g., EPRI).
- Academics, National Laboratories, and other researchers.
- Technology companies.

Water Reuse Federal Partner Profile

U.S. Environmental Protection Agency (EPA)

Washington, D.C.

Agency Mission

The EPA's mission is "to protect human health and the environment." With respect to achieving clean and safe water, the EPA's goal is to ensure that waters are clean through improved water infrastructure and, in partnership with states and tribes, sustainably manage programs to support drinking water; aquatic ecosystems; and recreational, economic, and subsistence activities (EPA 2018–2022 Strategic Plan).

Context and Applicability to Water Reuse

The EPA implements water resource programs under the authority of the Safe Drinking Water Act (SDWA), the Clean Water Act (CWA), and other statutes. The EPA and its state and tribal partners perform many functions and implement programs and requirements that have a direct and indirect influence on water reuse:

- National policy direction.
- Drinking water standards and regulations for the protection of public health:
  - Surface water pollution control programs.
  - Funding programs for water and wastewater infrastructure:
    - Clean Water State Revolving Fund.
    - Drinking Water State Revolving Fund.
    - Water Infrastructure Finance and Innovation Act (WIFIA).
- Grants to reduce nonpoint sources of pollution.
- Financial assistance to states and tribes to support CWA and SDWA implementation.
- Technical and programmatic guidance and training.
- Science and research.

Explicit Roles and Actions in Water Reuse

Funding for Water and Wastewater Infrastructure

- The *State Revolving Fund (SRF) Program,* implemented by the states, supports water and wastewater infrastructure. SRF funding can be used to support projects that include water reuse strategies:
  - The Clean Water SRF has provided more than $133 billion to support communities since 1987.
  - The Drinking Water SRF has provided more than $38 billion to support communities since 1997.
- The *WIFIA Program* accelerates investment in the nation's water infrastructure by providing long-term, low-cost supplemental loans for regionally and nationally significant projects.
  - In the most recent Notice of Financial Availability (February 15, 2019), Congress provided $60 million in budget authority, which is anticipated to help finance about $12 billion in water infrastructure investment. In the notice, the EPA explicitly identified water reuse and recycling as priority areas.

  - Example project: In 2018, the EPA provided a $614 million loan through the WIFIA program to the city of San Diego for an innovative water recycling project.

- The EPA has established the *Water Infrastructure and Resiliency Finance Center* to provide financing information to help local decision-makers make informed decisions for drinking water, wastewater, and stormwater infrastructure to protect human health and the environment.

Standards for the Protection of Public Health for Drinking Water

- The EPA has established primary drinking water regulations (i.e., Maximum Contaminant Levels or treatment techniques) for 90 contaminants that provide the baseline level of public health protection from consumption of drinking water.
- The EPA has established secondary drinking water standards (non-enforceable guidelines) for 15 other contaminants.

Surface Water Pollution Control Through the National Pollutant Discharge Elimination System (NPDES)

- The EPA administers the NPDES program to address water pollution by regulating point sources that discharge to waters of the United States. Many states implement NPDES programs through state primacy delegations. The NPDES permitting program, pretreatment program, and others play a role in many water reuse opportunities.

Underground Injection Control Requirements for Aquifer Recharge and Aquifer Storage and Recovery

- The EPA's Underground Injection Control (UIC) program regulates aquifer recharge and aquifer storage and recovery injection wells under the category of UIC Class V wells; these wells may require a permit through the state primacy program or the EPA.

Technical Guidance on Water Reuse

- The EPA has developed and issued four Guidelines for Water Reuse since 1980 (i.e., 1980, 1992, 2004, 2012). The EPA's two most recent related publications are the *2012 Guidelines for Water Reuse* and the *2017 Potable Reuse Compendium* to compile and share information on current and best practices.

Science and Research

- The EPA is engaging in research, including research collaborations with external partners, on new and existing water reuse practices. This includes research related to alternative water sources, understanding of public health risks, treatment targets and monitoring surrogates, and interactions between stormwater and groundwater to increase supplies but reduce potential contamination.
- In May 2019, the EPA completed a study, titled *Study of Oil and Gas Extraction Wastewater Management*, to evaluate how the Agency, states, tribes, and stakeholders regulate and manage wastewater from the oil and gas industry. Most of this wastewater is disposed of through underground injection; there may be opportunities to treat and reuse it for other purposes.

Examples of Partners and Stakeholders

- State and tribal environmental agencies and associations (e.g., ASDWA, ECOS, ACWA, National Tribal Water Council).
- Permitted entities (e.g., water utilities, wastewater utilities, municipal stormwater programs, oil and gas companies).
- Water sector associations/organizations (e.g., WRA, WEF, WERF, AWWA, NACWA, U.S. Water Alliance).
- Citizens.

Water Reuse Federal Partner Profile

U.S. Food and Drug Administration (FDA)

Center for Food Safety and Applied Nutrition (CFSAN)

College Park, Maryland

Agency Mission

The FDA is responsible for protecting the public health by ensuring the safety, efficacy, and security of human and veterinary drugs, biological products, and medical devices; and by ensuring the safety of our nation's food supply, cosmetics, and products that emit radiation.

Context and Applicability to Water Reuse

The Food Safety Modernization Act Produce Safety Rule establishes science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption. The rule focuses on major routes of contamination that can affect the safety of fruits and vegetables, and includes standards relating to the safe use of agricultural water throughout growing and postharvest activities.

In recent years, members of the produce industry have shown an interest in the use of reused water, recycled water, and graywater during the production of fruits and vegetables, and a desire to better understand how they can do so safely. FDA recognizes that this is an area of growing interest and remains committed to ensuring that industry has the knowledge and resources needed to reuse water in a way that is protective of public health and in compliance with the applicable regulations.

Explicit Roles and Actions in Water Reuse

Current

Examples of water reuse activities in which the FDA has played a role include:

- *Participating in educational farm visits* in which members of the growing community can share information about their water use and water quality management practices, including any interest they might have in water reuse.
- *Attending listening sessions* in which various stakeholders—including representatives from states focused on implementing water supply planning solutions—have the opportunity to share their perspectives on water reuse and what it means for the fresh produce industry.
- *Serving on the advisory committee* for a project aimed at facilitating the adoption of non-traditional water sources for use in irrigation of food crops.

Near Term

The FDA seeks to:

- *Better understand the challenges* the produce industry faces in meeting both water reuse and food safety goals.
- *Provide support as needed* to ensure that members of the fresh produce industry interested in water reuse have the information needed to do so in a way that is protective of public health.

Long Term

The FDA intends to support the EPA in its roll-out of programming in the water reuse action plan in a variety of ways, including:

- Supporting stakeholders—including the fresh produce industry and others—as interest in water reuse continues to evolve.
- Engaging with interested stakeholders to develop relationships and better understand the challenges faced when using a variety of water sources in the production of fresh produce.

Examples of Partners and Stakeholders

The FDA regularly engages in outreach with agricultural water stakeholders through a variety of means, including educational farm visits; attending and presenting at meetings of groups such as the International Association of Food Production (IAFP), the Institute of Food Technologies (IFT), and the American Water Resources Association (AWRA); and engaging with technical experts on challenges that growers face through using water in the production of fresh produce.

We welcome and encourage other stakeholders involved in water reuse to participate in discussions and opportunities to share knowledge and provide different perspectives as we move forward in our activities related to water use in produce production.

Water Reuse Federal Partner Profile

Agricultural Research Service (ARS)

Washington, D.C./Denver, Colorado

Agency Mission

The ARS conducts research to develop and transfer solutions to agricultural problems of high national priority and provide information access and dissemination. It seeks to ensure high-quality, safe food and other agricultural products; assess the nutritional needs of Americans; sustain a competitive agricultural economy; enhance the natural resource base and the environment; provide economic opportunities for rural citizens, communities, and society as a whole; and provide the infrastructure necessary to create and maintain a diversified workplace.

Context and Applicability to Water Reuse

The ARS provides research capability and already published studies on wastewater reuse in the agricultural sector. Recent work has focused on:

- The accumulation of salinity.
- Pathogen and pharmaceutical transport.

Explicit Roles and Actions in Water Reuse

Agriculture is one of the largest users of the nation's surface water and groundwater and thus has a large potential role in the reuse of wastewater to irrigate crops. The specifics depend on local climate. In dry climates where irrigation is needed for crop production, wastewater can supply all or part of evapotranspiration (ET) demand throughout the growing season. In more humid climates, wastewater should be viewed as a supplemental water source for irrigation during droughts. In these cases, use of wastewater for irrigation could help maximize food production during times of short-term water scarcity.

Future research to maximize the utility of wastewater for irrigation will focus on salinity management, preventing foodborne illnesses, preventing the development of antibody resistance, quantifying the effect of the accumulation of biologically active compounds (e.g., PFAS/PFOS, endocrine-disrupting compounds, and pharmaceutically active compounds) within the food chain, and cost-effective low input treatment methods for wastewater.

The ARS implements many national programs that may have a direct and indirect influence on local water reuse efforts:

- Water Availability and Watershed Management.
- Aquaculture.
- Sustainable Agricultural Systems Research.

Examples of ARS Research Projects

- *Case study on the Phoenix active management area.* The Phoenix active management area contains more than 60 percent of the total population of Arizona. Within the area, 82 percent of all wastewater produced is reused. One community within the active management area is the town of Gilbert, with a

population of about 250,000. In Gilbert, 100 percent of all wastewater produced is treated and reused for either groundwater recharge or landscape irrigation.

Over three years, the ARS evaluated natural soil processes' ability to remove pharmaceuticals from wastewater during groundwater recharge. It was determined that these processes prevented the accumulation of some pharmaceuticals. Others did accumulate, but at very low levels; in all cases, accumulation was less than 5 parts per billion over 30 years of groundwater recharge. These levels are orders of magnitude below the lowest therapeutic dose.

- *Low-input treatment methods for removing trace organics from wastewater.* The ARS investigated the ability for increased aeration to reduce the fate and uptake of pharmaceuticals in wastewater using an air injection system prior to subsurface drip irrigation. The air injection was shown to reduce the concentration of three pharmaceuticals (caffeine, carbamazepine, and gemfibrozil) in the soil and leachate. Uptake of caffeine and gemfibrozil into lettuce was lower in the air injection treatments, but carbamazepine uptake was greater. In addition, the air injection resulted in changes in the soil microbial community. Air injection may be a useful point-of-use treatment technology to reduce the environmental availability of pharmaceuticals.

For more information on research projects, search the ARS database here.

Examples of Partners and Stakeholders

- Farmers.
- States.
- Indian tribes or tribal organizations.
- Municipalities.
- Water districts.
- Wastewater districts.
- Rural water districts.
- Regional or local authorities.
- Individuals.
- Institutions of higher education.
- For-profit organizations.
- Nonprofit organizations.
- Federally funded research and development centers.

Water Reuse Federal Partner Profile

National Institute of Food and Agriculture (NIFA)

Washington, D.C.

Agency Mission

The NIFA's mission is "Invest in and advance agricultural research, education, and extension to solve societal challenges." Addressing critical water resource issues such as drought, excess soil moisture, and flooding is a top priority as climate-related changes pose uncertain and mixed challenges for American farmers and producers. NIFA supports research, education, and outreach toward development of management practices, technologies, and tools for farmers, ranchers, forest owners and managers, public decision-makers, and citizens to improve water resource quantity and quality.

The NIFA's Water Program focuses on critical water issues by developing regional systems for the sustainable use and reuse, flow, and management of water, as well as production and environmental sustainability efforts at the watershed and farm scales (NIFA Strategic Plan Subgoal 1.3).

Context and Applicability to Water Reuse

The NIFA funds water quality and quantity programs under the Agriculture Improvement Act of 2018 (the Farm Bill), which authorizes the Agriculture and Food Research Initiative (AFRI) flagship competitive and other funding lines. A domestically focused agency, the NIFA partners through competitive and capacity grants with universities, research laboratories, other governmental and nongovernmental organizations and tribes to improve the knowledge base and technology adoption of water reuse in agriculture. More specifically, the NIFA:

- Establishes national priorities for research, education, and outreach in the use of recycled water for agricultural irrigation, salt water intrusion, groundwater conservation and replenishment, surface water habitats, crop processing, and agroecosystem functioning.
- Creates irrigation guidelines for the use of recycled water on crops eaten fresh for food safety and the protection of public health.
- Secures water for agriculture by funding the use of nontraditional water sources.
- Promotes a new paradigm for water and water reuse education.
- Creates new processes for research translation and outreach.
- Advances science through research.

Explicit Roles and Actions in Water Reuse

Competitive Funding for Water Reuse in Agriculture Research (Research Only)

- AFRI foundational funding line, agricultural water sciences (investment $5 million):
  - Contaminants of emerging concern in recycled water affecting agroecosystems.
  - Contaminants of emerging concern from recycled water irrigating crops eaten fresh.
  - Antimicrobials and *Salmonella* uptake by crops irrigated with recycled water.
  - Endocrine-disrupting compounds found in turf irrigated with recycled water.

Competitive Funding for Water Reuse in Agriculture Research (Integrated Across Research, Education and Outreach)

- AFRI water for agriculture challenge area (investment: $10 million):
  - "Water Reuse, Food Production and Public Health: Adopting Transdisciplinary, Systems-Based Approaches to Achieve Water and Food Security in a Changing Climate."
  - Collaboration by memorandum of understanding with the EPA: organized workshop on food safety and water treatment for local and small farms.
- AFRI water for food production systems (investment: $34 million):
  - Water and nutrient recycling: a decision tool and synergistic innovative technology (L.F. Greenlee at the University of Arkansas; $4,342,280.00 for five years).
  - SmartPath: grower-directed convergence of nanotechnology and smart decision analytics for irrigation water quality management related to pathogens (E.S. McLamore at the University of Florida; $4,867,723 for five years).
  - Coupling domestic wastewater resources to urban controlled environment agriculture systems (Y. Chen at Georgia Tech University in Atlanta; $4,838,263 for five years).
- AFRI pre- and post-doctoral fellowships (investment: $1 million):
  - Green recycled and bio-compatible materials for wastewater reuse for crop irrigation (J.L. Morales at Recinto Universitario Mayaguez, Puerto Rico; $152,000 for two years).
  - Potential of woody substrate-based bioreactors to remediate plant pathogens in agricultural runoff for onsite water reuse (N. Bell at Clemson University; $89,000 for two years).
- Active Small Business Innovation Research (investment: $100,000):
  - Energy-positive wastewater treatment and reuse system for agriculture applications (Z. Huang at Cameron Innovation Inc.; $100,000 for two years).
- Specialty Crop Research Initiative (investment: $12 million):
  - Clean Water[3] (reduce, remediate, recycle): informed decision-making to facilitate use of alternative water resources and promote sustainable specialty crops (S. White at Clemson University; $8,700,000 for five years).
  - Integrated management of zoosporic pathogens and irrigation water quality for a sustainable green industry (C. Hong at Virginia Tech University; $2,700,000 for five years).

Capacity Funding for Water Reuse in Agriculture

- Active Hatch Act projects (examples):
  - Using high resolution mass spectrometry to assess the impacts of reclaimed wastewater use for crop irrigation (University of Connecticut).
  - Drought, reclaimed water, and complex interactions within agricultural systems (University of California at Riverside).
  - Water reuse, saltgrass selection, and carbon footprint of urban turfgrass systems (Colorado State University).
- Active Hatch multistate projects (example):
  - Beneficial reuse of residuals and reclaimed water: impact on soil ecosystem and human health (Project No. W-3170).

National Specialty Workshops

- Introduced agriculture as a potential customer for municipal wastewater treatment plants and offered opportunities and challenges in agricultural water reuse, Santa Rosa, California.

- State-of-the-science and issue-driven conference focused on water reuse in agriculture: ensuring food safety, Monterey, California.

New Data for Irrigation Water Use

- NIFA National Program Leaders for Water requested and were granted a new question in the USDA National Agriculture Statistical Service's Farm and Ranch Irrigation Survey (now called the Irrigation and Water Management Survey) focused on recycled water use in agriculture: Table 23, "Farms Using Recycled or Reclaimed Water: 2013 and 2008."

Technical Guidance on Water Reuse

- The NIFA edited the *2012 Water Reuse Guidelines* and contributed to Chapter 3, "Types of Reuse Applications—Discussion on Agriculture."

Science Policy

- The NIFA, in cooperation with the University of Connecticut and Purdue University, concluded a synthesis of 13 years of water quality and quantity funding and its relevance to water reuse technology adoption, nontraditional water source use, and water conservation practice efficacy.
- The NIFA helped write and edit the *Coordinated Strategic Plan to Advance Desalination for Enhanced Water Security*, a report by the Desalination Science and Technology Task Force, Subcommittee on Water Availability and Quality, and Committee on Environment (all part of the National Science and Technology Council).

Examples of Partners and Stakeholders

- Tribal colleges and associations (e.g., 1994 land-grant institutions, Native Waters on Arid Lands).
- Universities, NGOs, and research laboratories (e.g., 1862 and 1890 land-grant institutions; other universities with agricultural research capabilities; national, federal, and state research laboratories; the National Academy of Science and Engineering; private consultancies; USDA Climate Hubs; and the National Institutes of Water Research).
- Water sector associations/organizations (e.g., Water Education and Reuse Association, U.S. Water Partnership).
- Outreach and educational institutions (e.g., Water Education Foundation, Cooperative Extension, Universities Council on Water Resources).

Water Reuse Federal Partner Profile

Natural Resources Conservation Service (NRCS)

Washington, D.C.

Agency Mission

"Helping People Help the Land." The NRCS has a vision for productive working lands in harmony with a healthy environment. The NRCS improves the health of the nation's natural resources while sustaining and enhancing the productivity of American agriculture. It achieves this by providing voluntary assistance through strong partnerships with private landowners, managers, and communities to conserve, protect, restore, and enhance the lands and waters upon which people and the environment depend (NRCS Strategic Plan Update FY2016–2018).

Context and Applicability to Water Reuse

The NRCS mission of helping people help the land was originally established by Congress under the Soil Conservation and Domestic Allotment Act of 1935. Providing national leadership in a partnership that helps people conserve natural resources remains NRCS' principle tenet. In support of this mission, strengthening the stewardship of private lands through technology and research is a core strategic goal of NRCS. The Agency holds paramount its responsibility to meet the challenges of population increases, land use changes, and water supply deficits with science-based conservation systems. The cornerstone of the nation's long-term water resilience is the adoption of new science and technology that provides economically and environmentally sustainable solutions to water resource needs.

NRCS' leadership is supported by technical and financial assistance provided to its customers, our nation's agricultural producers. Pursuant to the 2018 Farm Bill, NRCS is directed to offer enhanced financial incentives to farmers who protect water quality and water quantity.

NRCS is committed to collaborative efforts with other federal agencies, state and local governments, tribes, and conservation partners to leverage resources to accomplish our shared responsibility of protecting human health and conserving natural resources.

Agriculture is one of the largest users of the nation's surface water and groundwater, with irrigation being the greatest use.[1] The NRCS supports agricultural producers who implement local-level conservation practices and management strategies that benefit water quality and improve water management. The NRCS has worked for decades to promote water conservation efforts, and water reuse is one of the approaches used to reduce stress on surface water and ground water supplies.

A common example of agricultural water reuse is collecting irrigation or drainage tailwater to help meet irrigation needs. The water is applied by gravity (from higher-elevation fields to those at lower elevations) or with a pump. Another example is the reuse of nearby municipal or industrial process water for agricultural irrigation.

The NRCS performs many functions and implements programs that may have a direct and indirect influence on local water reuse efforts:

[1] "Irrigated Agriculture in the United States," information compiled by USDA Economic Research Service (ERS) , from USDA's 2013 Farm and Ranch Irrigation Survey conducted every 5 years by the USDA National Agricultural Statistics Service (NASS).

- Financial assistance programs:
  - Conservation Innovation Grants (CIG).
  - Environmental Quality Incentives Program (EQIP).
  - Conservation Stewardship Program (CSP).
  - Agricultural Management Assistance Program (AMA).
  - Water Bank Program (WBP).
- Landscape Conservation Initiatives.
- National Water Quality Initiative (NWQI).
- Technical assistance.
- Service centers.
- National Water and Climate Center/Water Supply Forecasts.

Explicit Roles and Actions in Water Reuse

Financial Assistance Program for Agricultural Producers

- The NRCS' Conservation Innovation Grants (CIG) are competitive grants that drive public and private sector innovation in resource conservation. CIG projects inspire creative problem-solving that boosts production on farms, ranches, and private forest land —ultimately, they improve water quality, soil health, wildlife habitat and promote water conservation. NRCS recognizes both the water supply challenges facing our nation and the significant breadth of opportunity for expanding the application of reclaimed water. Accordingly, NRCS stands committed to supporting the development of innovative conservation approaches necessary to harness the value of recycled water in the coming years.
- The Environmental Quality Incentives Program (EQIP) assists farm, ranch, and forest production and improves and protects environmental quality. EQIP offers payments for 171 conservation practices, some of which are directly related to water resources (e.g., irrigation water management, irrigation and drainage tailwater recovery, pipeline , stormwater runoff control , waste transfer).
- The Conservation Stewardship Program (CSP) helps producers build on existing conservation efforts and strengthen operations. An example of this is advanced tailwater recovery. This is the largest conservation program in the United States, with more than 70 million acres of productive agricultural and forest land and thousands of people voluntarily enrolled.
- The Agricultural Management Assistance Program (AMA) provides financial assistance for installing conservation practices in the 16 states where participation in the Federal Crop Insurance Program is historically low. This program can provide up to 75 percent of the cost of a conservation practice, up to a $50,000 annual maximum per participant.
- The Water Bank Program (WBP) is designed to keep water on the land for the benefit of migratory wildlife such as waterfowl. Landowners and operators can sign new 10-year rental agreements to protect wetlands and provide wildlife habitat.
- The Regional Conservation Partnership Program (RCPP) offers new opportunities for the NRCS, conservation partners, and agricultural producers to work together to harness innovation, expand the conservation mission, and show the value and efficacy of voluntary, private lands conservation. RCPP projects may include conservation activities associated with other USDA programs, such as the EQIP, CSP, and PL 83-566 Watershed Program.
- The Watershed Protection and Flood Prevention Program (PL 83-566) helps federal, state, and local governments and tribes protect and restore watersheds up to 250,000 acres. This program provides for cooperation between the Federal government and the unit of governments and their political

subdivisions to work together to prevent erosion; floodwater and sediment damage; to further the conservation development, use and disposal of water; and to further the conservation and proper use of land in authorized watersheds. USDA's Natural Resources Conservation Service (NRCS) offers financial and technical assistance through this program for the following purposes: erosion and sediment control, watershed protection, flood prevention, water quality improvements, rural, municipal and industrial water supply, water management, fish and wildlife habitat enhancement, and hydropower sources.

Landscape Conservation Initiatives

- The NRCS uses Landscape Conservation Initiatives to accelerate the benefits of voluntary conservation programs, such as cleaner water and air, healthier soil, and enhanced wildlife habitat. These initiatives enhance the locally driven process to better address important conservation goals that transcend localities to the regional or national level. Approximately 10 water-based initiatives are underway. For example, the Ogallala Aquifer Initiative (OAI) aims to reduce aquifer water use, improve water quality, and enhance the economic viability of croplands and rangelands in Colorado, Kansas, Oklahoma, Nebraska, New Mexico, Texas, South Dakota, and Wyoming. The OAI's overall goal is to reduce withdrawals of water and support local projects that demonstrate how agriculture can be productive and sustainable in the Ogallala region. To achieve this, the NRCS has set five milestones for its work with producers and partners to complete by 2018. These milestones include the conservation of 102,320 acre-feet of water, improving irrigation efficiency on 49,400 acres, converting operations to dryland farming on 30,350 acres, installing 202 irrigation water management systems, and applying nutrient management practices on 21,000 acres.[2] Substantial progress has been made toward the achievement of each milestone as a direct result of the collaboration between NRCS and its partners as outlined in the *OAI 2017 Progress Report.*

National Water Quality Initiative

- As the USDA's premiere water quality initiative, the National Water Quality Initiative provides a way to accelerate voluntary, on-farm conservation investments and focused water quality monitoring and assessment resources where they can deliver the greatest benefits for clean water.

Technical Assistance and Service Providers

- The NRCS delivers conservation technical assistance to private landowners, conservation districts, tribes, and other organizations across the country through its voluntary Conservation Technical Assistance CTA program. This support can help in many ways, including to help land users protect and improve water quality and quantity and to develop and apply sustainable agricultural systems. The assistance may take the form of resource assessment, practice design, resource monitoring, or follow-up on installed practices. The CTA program provided more than $5 billion of technical assistance funds from 2003 to 2013. Between 2012 -2017 over $5M was spent just on tailwater recovery, not including associated practices that may have been used (pumps, pipelines, irrigation systems).
- NRCS will contribute to the development of water reuse program outreach and communications materials. This action will include the development of materials which showcase farmers and landowners who have successfully implemented water reuse systems on their farming or ranching operations. In addition, NRCS will contribute to the production of new materials based on the needs articulated by stakeholders. NRCS will develop training resources geared towards peer-to-peer knowledge transfer as well as a broader audience of stakeholders. NRCS will produce technical reference documents for the design of water reuse practices across agricultural landscapes.

[2] *Ogallala Aquifer Initiative 2017 Progress Report,* https://www.nrcs.usda.gov/Internet/FSE_MEDIA/nrcseprd1407817.pdf

- Technical service providers (TSPs) offer services to agricultural producers on behalf of the NRCS. TSPs help producers plan, design, and implement conservation practices or develop conservation activity plans to improve agricultural operations.

National Water and Climate Center/Water Supply Forecasts

- The National Water and Climate Center's staff publish water supply forecasts throughout the western United States; serve as technical specialists on issues of drought, soil moisture, and climate change; and provide database operations and management for snow pack, water supply, and climate data.

Examples of Partners and Stakeholders

- Farmers, ranchers, conservation districts, canal companies, irrigation districts.
- Private forestry operations.
- Local, state, and tribal agencies and associations
- Agricultural associations/organizations (e.g., the Agricultural Drainage Systems Management Task Force, the Irrigation Association).
- Citizen and recreation groups.
- Agricultural businesses (i.e., Agribusinesses).
- Other federal agencies, such as the U.S. Forest Service.

Water Reuse Federal Partner Profile

U.S. Geological Survey (USGS)

Reston, Virginia

Agency Mission

The USGS serves the nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect quality of life. Water information is fundamental to national and local economic well-being, protection of life and property, and effective management of the nation's water resources. The USGS works with partners to monitor, assess, conduct targeted research, and deliver information on a wide range of water resources and conditions including streamflow, groundwater, water quality, and water use and availability. (For more information, see the USGS's strategic plan for water science.)

Context and Applicability to Water Reuse

The USGS implements water resource programs under the authority of the Organic Act, the SECURE Water Act, and other statutes. As the nation's largest water, earth, and biological science and civilian mapping agency, the USGS collects, monitors, analyzes, and provides science about natural resource conditions, issues, and problems. Current and projected water demands will require many areas of the country to access alternative sources of water to meet multiple use needs.

The USGS draws on its diverse expertise to carry out large-scale, multidisciplinary investigations and provide impartial scientific information to resource managers, including assessments of water availability. Understanding how alternative sources of water (reuse, brackish, etc.) can be used, and are used, is an important component of availability. The USGS collects data on water reuse and collaboratively assesses water reuse in terms of availability with local and regional partners.

Explicit Roles and Actions in Water Reuse

The SECURE Water Act directly asks the USGS to assess including impaired surface water and groundwater supplies that are known, accessible, and used to meet ongoing water demands. While reused water may not be "impaired," it is accessible water that can be used to meet ongoing demands.

As part of its mission to give resource managers the data, tools, and information they need to make water management decisions, the USGS focuses on the following activities to improve understanding of water reuse and how it influences water availability:

- Modernized data collection, which can include improved water reuse data in applicable basins.
- Modernized data delivery.
- National water prediction capabilities.
- Integrated water availability assessments (IWAAs).

Examples of Partners and Stakeholders

The USGS's water resources mission area and its Science Centers and Regions partner with over 1,800 agencies, tribes, municipalities, universities, organizations, and research centers both locally and nationally.