



Providing Assistance & Solutions

In many areas of the United States, the frequency, intensity, and duration of drought events are increasing. This pattern is expected to continue and to shift outside of historical trends, making forecasting our water quality and supply more difficult. EPA is conducting research and working with stakeholders to better understand the impact of drought on water quality and availability, and to provide solutions to help communities conserve water.

Technical BRIEF

Agency-Wide Actions and Research

- Water Efficiency and Infrastructure
- Aquifer Recharge
- Water Reuse
- Desalination
- Response, Recovery, and Restoration
- Watershed Sustainability
- Available Resources

Water Efficiency and Infrastructure

WaterSense Program. EPA's WaterSense program helps people save water with a product label and tips for saving water indoors and out. Products bearing the WaterSense label have been independently certified to be at least 20 percent more efficient without sacrificing performance. EPA Region 9 has been working with the U.S. Department of Housing and Urban Development (HUD), and other housing agencies to incorporate water efficiency into their programs and projects via the WaterSense program and other tools. In addition, other EPA regions are also broadening outreach on WaterSense through collaborations with federal partners as part of the Executive Order 13693. epa.gov/watersense/

Water loss control training workshops for public water utilities and Tribal utilities. EPA Region 9 has participated in water loss control training workshops with the American Water Works Association and other partners, including Water Systems Optimization, Inc., the California Department of Water Resources and the California Urban Water Conservation Council. EPA Region 9 is planning additional water loss control workshops outside of California in 2016. EPA Region 7 is also providing a training workshop in 2016 focused on identifying and controlling water loss as a critical action to mitigate the potential impacts of drought in small and medium communities. EPA OW is conducting three workshops in 2016 in Kentucky, Missouri, and Utah covering drought and water loss issues.

Supporting water loss control auditing. EPA Region 9 is working with states and tribes to leverage the Drinking Water State Revolving Fund (DWSRF), EPA's largest funding source for improving drinking water infrastructure, to support water loss control auditing. This may also include adapting innovative work by states in other regions (including EPA Region 4 and Georgia) who are providing DWSRF grants to utilities to support water audits, and low-interest loans to cover the cost of needed infrastructure repairs identified as a result of the audits.

Impacts of Water Conservation on Water Quality in Premise Plumbing and Water Distribution Systems – National Priorities Grants. EPA's Office of Research and Development (ORD) is funding several grants to investigate issues of water quality and availability related to distribution systems and premise plumbing systems under lower-flow conditions. The research will provide a greater understanding of health risks associated with low flows and of methods to better size water distribution systems so that pipes provide the appropriate flow, at the available water pressure, to meet the real demand for water. epa.gov/research-grants/national-priorities-impacts-water-conservation-water-quality-premise-plumbing-and

Aquifer Recharge

Leveraging local programs to promote stormwater and rainwater capture for augmenting water supplies and replenishing groundwater aquifers. Working through the National Drought Resilience Partnership (NDRP), EPA Region 9 will work with municipalities and utilities, and leverage federal, state, and local programs to promote stormwater and rainwater capture to augment water supplies and replenish groundwater aquifers. This work would leverage green infrastructure projects in communities, possibly funded through State Revolving Funds (SRFs), with on-farm work funded through the U.S. Department of Agriculture's Natural Resource Conservation Service (USDA NRCS). Critical partners are the U.S. Bureau of Reclamation (USBR), the Federal Emergency Management Agency (FEMA), and the U.S. Geological Survey (USGS), among others.

Investigating innovative stormwater management for aquifer recharge in arid and semi-arid urban landscapes. EPA ORD is proposing a research project, in cooperation with extramural partners, that would investigate resilient water management under drought conditions, starting with select Department of Defense (DoD) installations in the Mojave desert, and future plans to explore technology transfer to metropolitan areas such as Los Angeles. Discussions are ongoing with the National Training Center at Fort Irwin whose water supply comes 100% from local aquifers and wastewater recycling. The project would involve the use of low impact development (LID)/best management practices (BMPs) such as strategically located and designed infiltration galleries and dry wells for opportunistic capture, infiltration and recharge of the infrequent rainfall events. System performance and subsurface water quality will be monitored. Integrated simulation modeling including catchment, vadose zone, and groundwater representation will be exercised in the design and evaluation phases.

Water Reuse

Human and Ecological Health Impacts Associated with Water Reuse and Conservation Practices (Science to Achieve Results (STAR) Grant). In order to research human and ecological health impacts associated with water reuse and conservation practices, EPA ORD announced \$3.3 million in awards to five institutions. Their research will measure the health and ecological impacts of water conservation practices like direct and indirect potable reuse and agricultural water reuse, and will also evaluate how reclaimed water applications, such as potable reuse, aquifer recharge, and irrigation, can affect public and ecological health. The following institutions received the research grants:

- *Water Environment Research Foundation (WERF), Alexandria, VA* – Will actively identify contaminant hotspots, assess the impact of those hotspots on human and ecological health, and quantify the impact of water reuse and management solutions.
- *University of Illinois at Urbana-Champaign* – Will develop a new framework to understand how adaptive UV and solar-based disinfection systems reduce the persistence of viral pathogens in wastewater for sustainable reuse.
- *Utah State University* – Will assess the impacts and benefits of stormwater harvesting using Managed Aquifer Recharge (MAR) to develop new water supplies in arid western urban ecosystems.
- *University of Nevada* – Will quantify microbial risk and compare the sustainability of indirect and direct potable water reuse systems in the United States.
- *University of California Riverside* – Will measure levels of contaminants of emerging concern (CECs) in common vegetables and other food crops irrigated with treated wastewater under field conditions, and evaluate human dietary exposure and potential adverse effects on land animals.

Additional information: epa.gov/ncer/abstracts/index.cfm/fuseaction/display.rfatext/rfa_id/591

Promoting indirect and direct potable water reuse. EPA's Office of Water (OW) is promoting a suite of options for long term water supply resilience in communities. Potable water reuse and recycling, both indirect (with an environmental buffer – typically a reservoir or aquifer) and direct (with an engineered buffer or without a buffer – pipe to pipe) play a crucial role in protecting water sources and are part of the suite of options. EPA Region 9 is serving on the California State Water Resources Control Board's Advisory Group for Direct Potable Reuse to develop regulations and guidance on the potable use of recycled wastewater. In this capacity, in 2016 Region 9 will review proposed regulations for indirect potable reuse via surface water augmentation, and recommendations regarding direct potable reuse.

Evaluating commercial rainwater harvesting systems for non-potable water supply. Public water supply resilience continues to be a major concern in regions of the U.S. susceptible to drought or potential water contamination. Decentralized water supply options, such as rainwater harvesting, can reduce environmental impacts and costs from a life-cycle perspective compared with augmentation of traditional municipal supplies (e.g. reservoir expansion). Capturing rainwater not only provides an additional water source, it also performs a stormwater management function by reducing stormwater runoff at the source and limiting the surge of rainwater into municipal water systems. EPA ORD research is building on the methodologies for life-cycle assessment and life-cycle costing of rainwater harvesting and green infrastructure developed in previous studies to evaluate commercial rainwater harvesting systems for augmenting water supplies in multiple U.S. locations.

Training on alternative sources of water for various uses. In 2015, EPA Region 4 led an inter-governmental "capacity-building" outreach effort by developing and presenting a series of five webinars with training materials on the topic of alternative sources of water for various uses, including potential installation of desalination plants. This effort was done in response to a request by the Government of Costa Rica (made under the auspices of the Central America Free Trade Agreement, "CAFTA") and submitted through the U.S. State Department and the U.S. Embassy in Costa Rica to EPA. The request was necessitated by recent climate-change induced water stress in the North Pacific region of Costa Rica. EPA presented 15 hours of training via live webinars to 23 officials from the Costa Rican Water & Sewer Institute, Ministry of Tourism, Ministry of Health, Electricity Institute, National Service for Groundwater, Irrigation and Drainage, the Ministry of Environment and Energy, and representatives from the Directorate of Water, National Technical Environmental Secretariat, the National Meteorological Institute, and the National System of Conservation Areas.

Planning for federal sustainability in the next decade- Executive Order 13693. Each EPA and General Services Administration regional office, in coordination with Federal Executive Boards, is convening regional interagency workgroups to identify and address federal sustainability including water resource management and drought response opportunities. Each workgroup has submitted a workplan to the White House on Council on Environmental Quality this year. For more information, see whitehouse.gov/the-press-office/2015/03/19/executive-order-planning-federal-sustainability-next-decade.

Treatment, monitoring, and risk assessment for fit-for-purpose water. EPA ORD will provide water quality data on treated water for a wide variety of finished water types, including irrigation, industrial, and other non-potable reuse categories. Studies will also examine next-generation systems and technologies for fit-for-purpose water treatment. EPA Region 9 is assisting in the development of appropriate operator training and certification requirements for the advanced treatment technologies associated with wastewater recycling systems, to help ensure reliability and consistency in facility operations. This work is being done in collaboration with key partners, including the California State Water Resources Control Board, American Water Works Association, WaterReuse Association, and water and wastewater utilities. Region 9 is also working with university and industry representatives at the Engineering Research Center for Reinventing the Nation's Urban Water Infrastructure (ReNUWit) to promote new technology and regulatory approaches for advancing wastewater recycling and explore ways to overcome institutional barriers.

Advancing water systems that encompass the entire water cycle. EPA ORD research will provide an integrated sustainability assessment framework that encompasses the entire water cycle for comprehensively advancing water systems—from source to tap and back to the source—and offer potential transformative alternatives to address a suite of issues facing water systems coupled with improved whole system efficiency. The framework will be developed based on linkages among drinking water, wastewater, stormwater, and natural/green infrastructure contained within specific watersheds. Transformative alternatives using a fit-for-purpose water treatment and resource-recovery concept will be developed and compiled in a toolkit inventory. This inventory will include tools to assess the sustainability of reuse and recovery infrastructure, including economic and social acceptance issues.

Desalination

Development and testing of decentralized desalination technology. Okeanos Technologies, a recipient of an EPA Small Business Innovation Research (SBIR) award, is developing and testing a new technology that they believe is more efficient than conventional desalination processes. The researchers believe that this new energy-efficient seawater desalination technology could provide “clean, cheap and plentiful water for everyone, anywhere.” Instead of using large conventional desalination plants, they are developing a microdevice that can desalinate water more efficiently. The technology will cut costs to a point where desalination can take place off-grid, allowing it to be used where it’s needed most. <https://blog.epa.gov/blog/2015/11/changing-the-water-distribution-model/>

Development of desalination technology for small water systems. Physical Optics Corporation, a recipient of an EPA SBIR award, is developing a novel, cost-effective desalination system that will enable small water systems to include lower quality source water at their intake, further reducing the demand of ground and surface water supplies. The system is based on a portable desalinator unit recently developed by Physical Optics Corporation that converts brackish water and seawater into quality drinking water, putting less stress on freshwater resources. Because of its size, the unit can not only be used to transform the intakes of small systems where freshwater is unavailable. <https://blog.epa.gov/blog/2015/11/changing-the-water-distribution-model/>

Salt-tolerant algae for biofuel production and salinity removal from brackish and sea-waters. ORD scientists are growing salt-tolerant or halophyte algae in a laboratory photo-bioreactor under optimized process conditions to remove salinity from brackish and seawater. Potential hybrid desalination, where the biodesalination serves as a pretreatment to membrane technology, reduces the energy footprint and the financial costs of desalination. In addition, the growing algae can be used for the mitigation of carbon dioxide from point source emissions. Once the algae has been used for desalination, it can then be harvested and used as a raw material for biofuel production. This research was funded out of EPA-ORD’s Pathfinder Innovation Projects (PIP) Program which aims to develop and foster innovative technologies and methods for solving environmental problems. Collaborative efforts include two ongoing cooperative research and development agreements (CRADAs) that include work with Aquatech International Corp, the Illinois Sustainable Technology Center, and University of Illinois Urbana-Champaign.

Scientific support for efficient brine management and water recovery technology options. ORD will evaluate technological advances in membrane-based processes of membrane distillation, vacuum membrane distillation, forward osmosis and pervaporation for water recovery and salt crystallization from saline streams. The research will focus on identifying, designing and demonstrating separation materials/processes that will enable the recovery of water from compromised water sources, using brine streams as a benchmark source material. It will involve material and membrane development, membrane testing and characterization, process design and demonstration, and technology development leading to implementation. The objective of this research is to provide scientific support regarding efficient brine management and water recovery technology options to EPA program and regional offices, states, tribes and the regulated industries. It is particularly relevant to inland Regions that need alternative water sources and cost effective options for managing brine concentrates produced by desalination systems used to meet fresh water needs.

Response, Recovery, and Restoration

Systems-Based Strategies to Improve the Nation's Ability to Plan and Respond to Water Scarcity and Drought (National Priorities Grants). EPA awarded grants to four institutions to investigate how drought and wildfire may impact surface water and groundwater quality:

- *Clemson University* – Will investigate the consequences of different fuel reduction techniques, as watershed management practices against wildfire, on the exports of dissolved organic matter from forested watersheds and associated biogeochemical processes and impacts on drinking water supplies.
- *Water Research Foundation, University of Colorado at Boulder* – An integrated framework will be developed to help understand the variability of key water quality parameters and their threshold exceedances and a decision tool for evaluating adaptation strategies will be developed.
- *University of Utah* – Will develop an improved system-wide quality and quantity model of the Jordan River watershed that can be used by stakeholders to improve sustainable planning efforts.
- *Public Policy Institute of California, University of California, Davis* – Innovations developed will improve water management by reducing risks associated with inadequate drought preparedness, including both pre-drought planning and emergency response.

Additional information:

epa.gov/ncer_abstracts/index.cfm/fuseaction/recipients.display/rfa_id/589/records_per_page/ALL

Development of tools and guides for drought resilience. EPA OW released *Drought Response and Recovery: A Basic Guide for Water Utilities* (see *Available Resources* section) which relays lessons learned from seven diverse small- to medium-sized utilities and provides worksheets, best practices, and videos that outline key emergency response actions that also build long-term drought resilience. An *Incident Action Checklist for Drought* is also available that lists quick reference items to prepare for, respond to, and recover from drought (see *Available Resources* section).

Drought response and recovery workshops for utilities. In December 2015, EPA OW, working with the National Drought Resilience Partnership (NDRP), conducted two drought response and recovery workshops for water utilities in the Central Valley of California (Merced County and Tulare). The workshops focused on best practices using EPA's innovative and interactive tool, *Drought Response and Recovery: A Basic Guide for Water Utilities* (see *Available Resources* section).

Direct assistance to water utilities conducting drought risk assessments. EPA's Climate Ready Water Utilities (CRWU) initiative is working with utilities across the U.S. to help them better understand the vulnerability of their drinking water and wastewater infrastructure and operations to current and potential climate-related impacts, including drought. These assessment exercises, using EPA's Climate Resilience Evaluation and Awareness Tool (CREAT), bring together individuals from utilities, surrounding communities, and EPA Regions to think critically about drought, prioritize vulnerable water resources and assets, then evaluate possible adaptation options and how these options would reduce consequences. To date, 23 utilities have completed their assessments with EPA's assistance and 5 more exercises are underway in 2016. Links to CREAT and videos telling the stories from some of these utility experiences can be found on the CRWU homepage at epa.gov/crwu

National Disaster Recovery Framework (NDRF) activated for drought in Nebraska. The NDRF was activated for the first time for drought in Nebraska. USDA led the Nebraska drought response in 2012. USACE was the coordinating agency for the Infrastructure Systems Recover Support Function (IS RSF). EPA was the support agency under the IS RSF where the mission was to provide technical advice and assistance on water and waste water infrastructure projects. EPA also provided technical assistance for using environmentally sound and sustainable approaches building infrastructure systems.

Tribal communities collaborate with state and federal partners on infrastructure needs. EPA Region 9 and the Indian Health Service are convening federal and state partners to coordinate information on infrastructure needs and funding, technical assistance, emergency drought relief, and conservation opportunities for tribes. Federal and state partners include the USDA Rural Development, HUD, USBR, U.S. Army Corps of Engineers (USACE), Bureau of Indian Affairs, USGS, California Office of Emergency Services, California Department of Water Resources, and the California State Water Resources Control Board. The *Drought Planning Handbook Emergency Drinking Water Supply for California Indian Tribes*, created in 2015, explained how the handbook can be used for drought planning anywhere in Region 9. Coordination will continue and the development of additional multi-agency resources will be considered. [irs.gov/california/tasks/sites/default/assets/File/DSFC-DroughtHandbook-Oct2015.pdf](https://www.irs.gov/california/tasks/sites/default/assets/File/DSFC-DroughtHandbook-Oct2015.pdf)

Midwest Climate Outlook and Drought Early Warning System Kickoff (Midwest DEWS). EPA Regions 5 and 7 participated in the kickoff of the Midwest DEWS in Saint Louis, Mo. in February, 2016. This kickoff included a diverse group of federal, tribal, state, and local stakeholders. Some of the desired outcomes of the meeting were to increase our knowledge and awareness of available data, monitoring activities and decision support tools for drought and high precipitation events and to identify effective communication resources. The early warning system will assist the agricultural communities as well as communities throughout the Midwest region in managing the potential effects of drought. On-going work will be posted to the National Integrated Drought Information System (NIDIS) website.

Watershed Sustainability

Products and services to help communities identify watershed problems and find solutions, including issues of water scarcity and drought. Started in 2007, EPA's Centers of Excellence for Watershed Management Program located in EPA Region 4 works with colleges and universities from across the Southeast to provide hands-on, practical products and services for communities to identify watershed problems and solve them, including issues of water scarcity and drought, as well as emerging issues of climate resilience and water utility infrastructure sustainability. Each EPA designated Center actively seeks out watershed-based stakeholder groups and local governments that need cost-effective tools for watershed scientific studies, engineering designs and computer mapping, as well as assistance with legal issues, project management, public education and planning.

Quantifying extent and impact of drought conditions affecting watershed resilience and integrity. EPA ORD is conducting three interrelated research activities on 1) establishing baseline data and maps of vulnerable waters affected by drought conditions in select areas of the western and mid-western U.S., 2) quantifying and reporting the potential effects of drought on watershed-scale water quality and quantity, and 3) identifying critical nodes to maintaining biodiversity at genetic, species, and ecosystem levels in watersheds affected by drought conditions. With phased support in the future, these analyses can provide informed scenarios to mitigate the effects of climate- or development-induced drought on watershed integrity, including the maintenance of adequate water quality and quantity for human and ecological health.

Effect of drought on background specific conductivity and associated loss of aquatic life. EPA ORD is evaluating the effect of drought on the extirpation (local extinction) of aquatic organisms in streams and basins. Three different drought scenarios will be used: moderate localized drought, extensive drought, and multi-year drought. Specific conductivity positively correlates with the concentration of total dissolved solids in water. The change in specific conductivity associated with drought will be modeled nationally at the reach-scale. Predicted base flow conductivity will be validated by comparing predicted values with values measured in nominal, wet and dry years. Biological effects will be predicted by the background to criterion model. U.S. national maps for each drought scenario will be produced to show predicted conductivity and percent loss of genera. The predicted percentage loss of genera will be validated using biological data from drought years or the subsequent year depending on genus natural history. Nationally, vulnerable areas will be identified based on recovery potential, areal extent of affected area, and severity of effect. Considerations and options for application of water quality criteria for specific conductivity will be described.

Development of regional monitoring networks to detect climate change effects in stream ecosystems.

Few monitoring agencies have collected adequate time-series data to support analyses of long-term trends or shifts in the biological, thermal, and hydrological regime of minimally disturbed, free-flowing freshwater streams. Such data are necessary to further our understanding of how changing conditions will affect streams, their ability to be used in assessments and to inform various entities on the relative importance of climate change compared to other stressors. To help address these data gaps, ORD has been collaborating with states, tribes and EPA regional offices to develop connected regional monitoring networks.

National-scale projections of climate change under multiple scenarios through 2100. Drought can have wide-reaching regional effects or be localized in scale. EPA ORD is developing hourly projections of climate change across the contiguous U.S. within 36 x 36 kilometer cells to examine frequency and severity of drought across multiple spatial and temporal scales. These projections can be used to examine potential changes to temperature and precipitation extremes and the cascading impacts on sensitive ecosystems. These data address issues at the nexus of three of the four ORD roadmaps for cross-cutting research (epa.gov/research/research-roadmaps): *Climate Change, Nitrogen & Co-Pollutants, and Environmental Justice*. These data can be used to examine changes in nutrient loading to sensitive ecosystems, including the Mississippi River at the Gulf of Mexico, the Chesapeake Bay, and others. In addition, these data can be used to develop approaches to creating intensity-duration-frequency curves that reflect potential changes to future climate, as well as anticipate effects of drought on agriculture across the Nation. Lastly, these modeling approaches holistically examine impacts of climate changes on air quality, health, water quantity, and ecosystems using dynamically consistent Agency tools.

A national-scale assessment of the impacts of lake level decline, and the separate influences of management and drought. Communities benefit from the ecosystem services provided by the Nation's lakes and reservoirs, particularly the hydrologic capacity to buffer against the impacts of flooding and drought. Water management and drought can lead to increased fluctuation and declines in lake and reservoir water levels that can adversely affect near-shore physical habitat and the biotic assemblages that depend water levels. Causes of lake level declines include direct and indirect water withdrawals for agriculture and urban growth, land use-driven changes in surface runoff, and changes in precipitation and evaporation driven by climate change. Effective management to maximize ecosystem services from these waters and minimize damages from declining levels requires quantification of lake level decreases, regional ranking of their probable causes, and estimation of changes in habitat quality associated with changes in lake levels. ORD will first quantify national and regional patterns of lake drawdown based on National Lakes Assessment (NLA) summer surveys measuring "bathtub rings" indicating lake level fluctuations. Changes in physical habitat complexity associated with drawdown will be further examined. ORD will then examine associations between these NLA drawdown measurements and water isotope information from the 2007 and 2012 surveys to first separate drawdown into that caused by evaporation and that caused by water usage. This probable-cause analysis will be refined using LAKECAT and other GIS geoclimatic and landuse/landcover information to infer more specific causes of lake level fluctuation.

Incorporation of decreased low flows and climate change impacts on wetland projects. EPA Region 7 worked with USACE, Section 404 programs to incorporate climate change impacts in permits, compensation plans and draft Environmental Impact Statement documents. In Missouri, Region 7 has included climate change implications and how to address climate change in National Environmental Policy Act documents for two proposed reservoir projects: Little Otter Creek Reservoir and East Locust Creek Reservoir. EPA also recommended alternatives be considered that do not cut off flood plain or upstream habitat from downstream habitat. This would include consideration of increased flows and decreased low flows due to increasingly varied climate precipitation patterns.

Agricultural community management practices. EPA Region 9 has supported projects in vineyards and orchards implementing management practices that reduce irrigation demand, retain soil-moisture, and minimize soil loss. In the Napa River and Sonoma Creek watersheds, Clean Water Act 319 and San Francisco Bay Area Water Quality Improvement Funds continue to support projects led by the California Land Stewardship Institute and the Sonoma Resource Conservation District, as well as other partners, to develop farm plans that promote growing practices that control and minimize soil and nutrient loss, such as enhancing infiltration of stormwater, floodwater, and rain to reduce runoff, while providing substantial watershed and water quality benefits.

Watershed Management Optimization Support Tool (WMOST) for optimizing water resources

management options over variable climate regimes. WMOST was created by EPA ORD to allow water resources managers to evaluate a broad range of technical, economic, and policy management options within a watershed. Version 1 evaluates cost-effectiveness of conservation options for source water protection and infiltration of stormwater on forest lands, green infrastructure stormwater best management practices (BMPs) to increase infiltration, and other water-related management options. Version 2, a joint effort between EPA Region 1 and ORD, has enhanced functionality to evaluate climate extremes, BMPs, and flooding costs/risks as part of the cost/benefit analysis. Case studies are available to demonstrate how communities have assessed strategies to maintain baseflows and water supply. Work is underway on modules to add functionality to WMOST to support robust decision making in the face of climate change.

WMOST Version 1: epa.gov/exposure-assessment-models/wmost-10-download-page

WMOST Version 2: cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=3111013

Draft EPA-USGS technical report: *Protecting Aquatic Life from Effects of Hydrologic Alteration.* EPA OW and USGS released this draft technical report for a 60-day public comment period on March 1, 2016. The report provides information to help states, tribes, territories, water resource managers, and other stakeholders responsible for the maintenance of hydrologic flow regimes. It describes the relationship between hydrologic condition and water quality, and gives examples of what states have done to address flow concerns using Clean Water Act authorities and programs that can be used to support the natural flow regime and maintain aquatic life. The report also provides a flexible, nonprescriptive framework to quantify flow targets to protect aquatic life from the effects associated with flow alteration. Stresses on aquatic life associated with hydrologic alteration may be further exacerbated through climate change. Recent climate trends have included the change in frequency and duration of extreme weather events, such as droughts and floods, which can have an impact on flow and affect aquatic life. epa.gov/wqc/draft-epausgs-technical-report-protecting-aquatic-life-effects-hydrologic-alteration-documents

Available Resources

U.S. Drought Portal – National Integrated Drought Information System (NIDIS)

This portal provides early warning on emerging and anticipated droughts, assimilates quality control data for droughts and models, provides information to agencies and stakeholders on risk and impact of droughts; provides information on past droughts for comparison and to understand current conditions, explains how to plan for and manage impacts of drought, and provides a forum for stakeholders to discuss drought-related issues. drought.gov

Drought in America – White House

This website highlights President Obama and his Administration's commitment to provide assistance to the farmers, ranchers, small businesses, and communities throughout the country whose lives and livelihoods are impacted by drought. In March 2016, the President issued a Memorandum and a Federal Action Plan on building national capabilities for long-term drought resilience. whitehouse.gov/campaign/drought-in-america

WaterSense Program

WaterSense helps people save water with a product label and tips for saving water indoors and out. Products bearing the WaterSense label have been independently certified to perform well; help save water, energy, and money; and encourage innovation in manufacturing. epa.gov/watersense/

Water Research Grants

EPA funds water research grants to develop and support the science and tools necessary to develop sustainable solutions to 21st century water resource problems, ensuring water quality and availability in order to protect human and ecosystem health. <https://www.epa.gov/research-grants/water-research-grants>

Climate Ready Water Utilities (CRWU) Initiative

CRWU provides drinking water, wastewater, and stormwater utilities with the practical tools, training, and technical assistance needed to adapt to climate change by promoting a clear understanding of climate science and adaptation options. Information on training events and links to online resources and tools, including the Extreme Events Workshop Planner and the CRWU Adaptation Strategies Guide, can be found on their homepage: epa.gov/crwu

Drought Incident Action Checklist

“Rip and run” styled checklist that drinking water and wastewater utilities can use to help with emergency preparedness, response, and recovery activities. epa.gov/waterutilityresponse/access-incident-action-checklists-water-utilities

Drought Response and Recovery: A Basic Guide for Water Utilities

Published in 2016, this interactive, user-friendly guide provides worksheets, best practices, videos and key resources for responding to drought. It is divided into four main sections: staffing, response plans and funding, water supply and demand management, communication and partnerships, and case studies and videos. epa.gov/waterutilityresponse/drought-response-and-recovery-water-utilities

Public Awareness Kit for Utilities

This kit is used to help inform customers and community members about the threats to their water system and motivate them to take action. By using several of the most effective communications methods—print, web, and TV—it will help officials reinforce the message and drive home the call to action. epa.gov/communitywaterresilience/water-utility-public-awareness-kit

Climate Resilience Evaluation and Awareness Tool (CREAT)

CREAT, developed under EPA’s Climate Ready Water Utilities (CRWU) initiative, assists drinking water and wastewater utility owners and operators in understanding potential climate change threats and in assessing the related risks at their individual utilities. CREAT guides users through identifying threats based on climate change projections and designing adaptation plans based on the types of threats being considered. epa.gov/crwu/assess-water-utility-climate-risks-climate-resilience-evaluation-and-awareness-tool

National Water Program Climate Adaptation Tools

This fact sheet provides a summary of tools developed by EPA for state, tribal, and local governments and others to adapt their clean water and drinking water programs to a changing climate. epa.gov/climate-change-water-sector/national-water-program-climate-change-adaptation-tools-summary

Watershed Management Optimization Support Tool

WMOST is a decision support tool that evaluates the relative cost-effectiveness of management practices at the local or watershed scale. cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=311013

All Hazards Boot Camp

This training course is designed for water and wastewater employees responsible for emergency response and recovery activities. It also explains why and how to implement an all-hazards program. Prevention and mitigation, preparedness, response and recovery are all topic covered during the training course. epa.gov/waterresiliencetraining/waterwastewater-utility-all-hazards-bootcamp-training#all-hazards

Environmental Finance Center (EFC)

EFCs deliver targeted technical assistance to, and partner with states, tribes, local governments, and the private sector in providing innovative solutions to help manage the costs of environmental financing and program management. epa.gov/envirofinance/efcn

Federal Funding for Utilities in Natural Disasters (Fed FUNDS)

Fed FUNDS provides tailored information to water and wastewater utilities about applicable federal disaster funding programs for national-level disasters. The funds could also apply to large-scale and even local disasters that result in service interruptions and significant damage to the critical water/wastewater infrastructure. epa.gov/fedfunds

State Revolving Fund (SRF) – Green Project Reserve

The American Recovery Act of 2009 requires all Clean Water SRF programs to use a portion of their federal grant for projects that address green infrastructure, water and energy efficiency, or other environmentally innovative activities, including practices such as green infrastructure and water reuse. epa.gov/cwsrf/green-project-reserve-guidance-clean-water-state-revolving-fund-cwsrf

Sustainability and the Clean Water State Revolving Fund (CWSRF) – A Best Practices Guide

This guide contains references to certain documents EPA believes would be helpful to state SRF programs as well as suggestions for new and innovative practices that are not widespread among the states which could promote the goals of the sustainability policy and benefit state CWSRF programs. epa.gov/sites/production/files/2015-04/documents/sustainability_best_practices_guide.pdf

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