

# WaterSMART

Progress Report 2010 - 2016



DECEMBER 2016



## Mission Statements

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

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.

# **WaterSMART**

## **Progress Report 2010 – 2016**



## Message from the Secretary

As Secretary of the Interior, one of my proudest accomplishments has been the steady advance of the landscape-scale approach to natural resource stewardship. Nowhere is this approach more needed than in water resources.

Across the country – including the arid West – climate change, population growth and urban development are creating challenges for America’s families, businesses, farms, industry and natural heritage. At the Department of the Interior, we are meeting this challenge by pursuing new, creative ideas and solutions that will help ensure a stable and secure water supply for future generations.

The WaterSMART program embodies the basin-scale approach to water resource management that this country needs. In 2010, Interior established the program to stretch limited water supplies by improving water conservation, and helping water-resource managers develop the tools they need to make sound decisions about water use.

This report describes the Program’s accomplishments as we work with partners to pursue a sustainable water future.

Through its Basin Studies Program, Reclamation has worked in cooperation with States, Tribes, local partners, and other stakeholders to evaluate 25 river basins and their ability to meet future water demands, and to identify adaptation and mitigation strategies that would address imbalances between water supply and demand caused by drought, climate change, population growth and other stressors.

Sound science provides the foundation for our water programs. The U.S. Geological Survey has implemented a National Water Census, which now provides more accurate information about the quantity of the Nation’s water resources and improved forecasting of water availability.

Through its grant programs, the Bureau of Reclamation has invested to stretch our scarce water supplies, so we can have clean water for drinking, agriculture and other economic activities, recreation, and ecosystem health. Importantly, Interior established a performance goal of conserving of over one million acre-feet of water by the end of 2017 – about the annual household use in the city of Phoenix and surrounding areas. Through projects funded from 2010 to 2016, Interior has now met and exceeded that goal.

The WaterSMART program now includes a new, proactive approach to addressing drought, support for watershed groups as they form local water management solutions, and investments in new institutions to support market-oriented approaches to water management. This innovation and constant improvement is essential given the dynamic nature of climate and hydrology, and a hallmark of a well-run program.

It is often said that water is the lifeblood of communities, and I’m proud of what we are accomplishing through the WaterSMART program to meet the water challenges of our time and help sustain a healthy nation.

SALLY JEWELL  
Secretary of the Interior



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# WaterSMART: Progress Report

## 2010 – 2016

Water is our most precious natural resource and is increasingly stressed by the demands our society places on it. Significant climate change-related impacts on water supplies are well documented in the scientific literature and scientists are forecasting changes in hydrologic cycles.

In 2009, Congress passed the SECURE Water Act directing the United States Department of the Interior (Interior) to develop a sustainable water management policy. In 2010, Interior established WaterSMART (Sustain and Manage America's Resources for Tomorrow), combining existing programs with new initiatives to create a broad framework for wisely managing the Nation's water supplies.

This report provides an overview of the steps taken under WaterSMART to date and highlights some specific actions that have been carried out. The report also describes the ways the program has evolved since 2010 and proposes a path forward given the water management challenges faced across the West.

## Improving Water Management through Collaboration and Cooperation

Interior is the Nation's largest wholesaler of water, steward of one-fifth of the Nation's land, and administrator of the United States' trust responsibilities to Native Americans. Our understanding of water resource management has expanded from supplying water for domestic and irrigation needs to also providing water for ecosystem health, municipal and industrial demands, energy and economic development, and recreation.

At the same time, multiple levels of government and non-governmental organizations are involved. State laws govern the use, allocations, and management of most water resources and local laws govern many land use decisions. Communities are increasingly attuned to the need for water to ensure healthy ecosystems and avoid environmental degradation, and conservation groups are spearheading this agenda.

WaterSMART provides opportunities to improve water management through collaboration and cooperation. Through WaterSMART, Interior provides leadership by identifying strategies to ensure that this and future generations will have sufficient supplies of clean water for drinking, economic activities, recreation, and ecosystem health. Interior implements the WaterSMART Program through the Bureau of Reclamation (Reclamation) and the U.S. Geological Survey (USGS).

*SECURE: Science and Engineering to Comprehensively Understand and Responsibly Enhance*

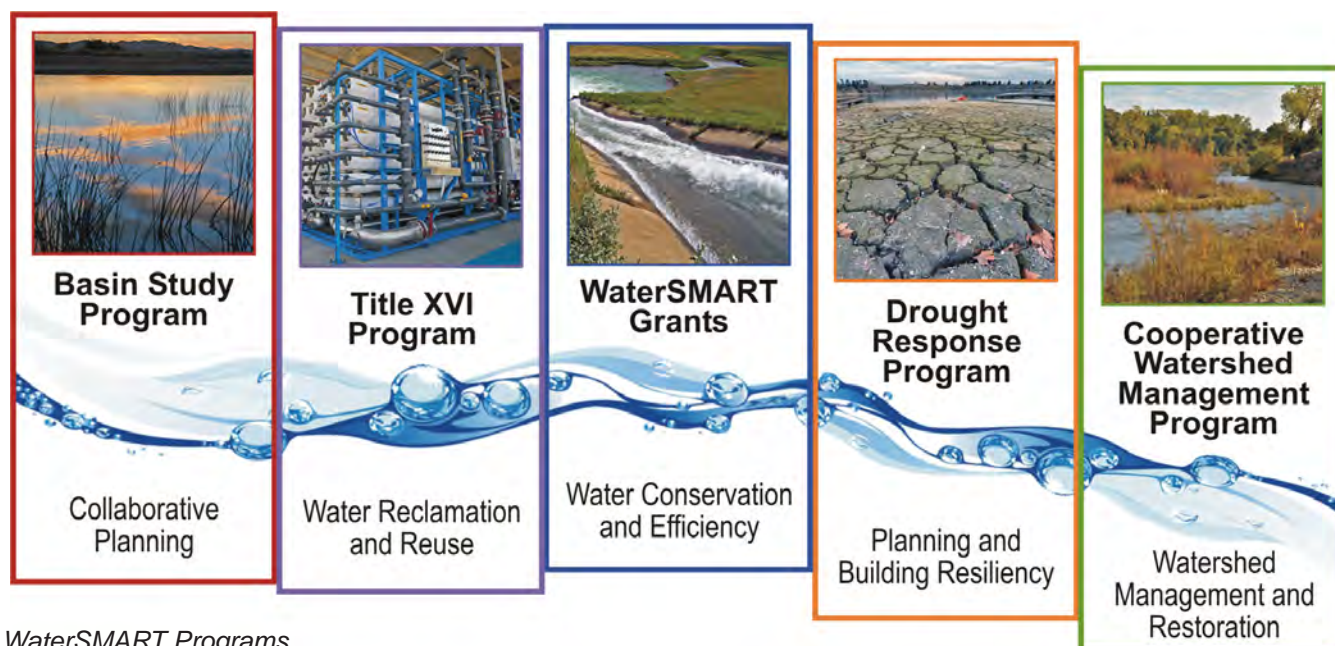


*WaterSMART: Sustain and Manage America's Resources for Tomorrow*

*Interior issued a Three-Year Progress Report on WaterSMART in 2012. The report highlighted steps being taken through the program to save water, to find better ways to stretch water supplies, and to help partners plan to meet future water demands.*



*This is the second WaterSMART Progress report published by the Department of Interior highlighting accomplishments from 2010 through 2016.*



*WaterSMART Programs highlighted in this report include the five complementary Western Reclamation programs in the figure above as well as the nationwide USGS WaterSMART activities under the Water Availability and Use Science Program. (see pages 49 through 57).*

## Bureau of Reclamation

Reclamation plays a key role in the WaterSMART program as Interior's primary water management agency. Focused on improving water conservation and helping water and resource managers make wise decisions about water use, Reclamation's portion of the WaterSMART program is achieved through administration of grants, scientific studies, technical assistance, and scientific expertise.

## U.S. Geological Survey

Under WaterSMART, USGS is working to integrate its existing research on various aspects of water availability and use, to identify key gaps in scientific capacity, and to invest in the development of new, cutting edge hydrologic tools and assessments to fill the most critical information gaps. Importantly, USGS is working more directly with stakeholders through WaterSMART to identify information gaps most critical for the types of management decisions and uncertainties that they face. Science developed through the USGS WaterSMART Program supports sustainable water managements actions undertaken in the Reclamation WaterSMART Programs.

## The National Drought Resilience Partnership

In March 2016, President Obama issued a [Memorandum](#) and Action Plan on Building National Capabilities for Long-Term Drought Resilience. The Memorandum elucidates the role of the National Drought Resilience Partnership, a team of Federal agencies, in helping communities manage drought impacts by linking information, such as forecasts and early warnings, with drought preparedness strategies in critical sectors like agriculture, municipal water systems, tourism and transportation. WaterSMART activities play an important role in carrying out the Action Plan. For example, Reclamation

*See the Long-term Drought Resilience Federal Action Plan of the National Drought Resilience Partnership here: [https://www.whitehouse.gov/sites/default/files/docs/drought\\_resilience\\_action\\_plan\\_2016\\_final.pdf](https://www.whitehouse.gov/sites/default/files/docs/drought_resilience_action_plan_2016_final.pdf)*



is coordinating with U.S. Department of Agriculture's National Resources Conservation Service (NRCS) to leverage WaterSMART funding for water delivery agencies with NRCS funding for agricultural producers. See pages 24-25.

Reclamation is also contributing to the National Drought Resilience Partnership through the Missouri Headwaters Basin pilot in southwest Montana, including WaterSMART Basin Study Program and Drought Response Program activities. See Page 37. Through WaterSMART, Reclamation is also working to explore how climate change information about water supplies could be incorporated into operations of its reservoirs and is coordinating with the U.S. Army Corps of Engineers (USACE) where storage is co-managed. See page 60.

## Climate Change Adaptation

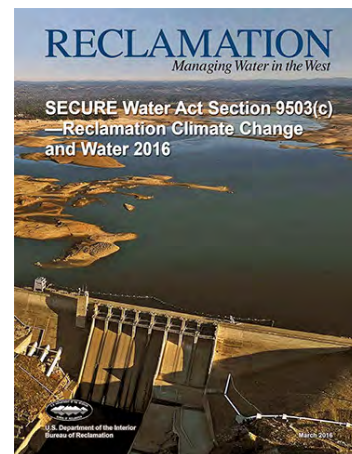
Through WaterSMART, Interior and its partners are building on the successes of many existing activities to support initiatives on climate adaptation and drought resiliency. New complementary programs and funding mechanisms are also incorporated into WaterSMART to develop the science, technology, funding, and collaboration tools needed for us to better understand how much water we have, how much we need, and how to close the gap between supply and demand. Solutions to complex water resource challenges now and in the future will require finding balance among the many uses of water that support people, the economy, and the environment.

In March 2016, Reclamation released the SECURE Water Act Report to Congress, which identifies that warmer temperatures, changes to precipitation, snowpack and the timing and quality of streamflow runoff are threats to water sustainability in the 21st century. The report highlights on-going collaboration between Reclamation and stakeholders to improve climate resiliency in the West. A comprehensive summary of on-going climate change adaptation activities is also provided in the report, including Reclamation's work with an array of partners to cost-effectively develop new water sources and make the most of existing supplies through WaterSMART.

## Data and Information Sharing

To support the President's Open Data Policy and Department of Interior's Open Water Data Initiative, a data visualization site has been produced to accompany this report. This tool allows users to view information on each of the complementary WaterSMART Programs including a link to the USGS National Water Census Data Portal (<http://arcg.is/1TcT68S>).

*In November 2014, Reclamation published its Climate Change Adaptation Strategy to build on existing actions and identify new activities that extend climate change adaptation efforts across Reclamation's mission responsibilities.*



*The SECURE Water Act Report and companion data visualization tool are available here:*

<https://www.usbr.gov/climate/secure>





In 2010, Interior established WaterSMART.



In 2010, the existing Title XVI Water Reclamation and Reuse Program was incorporated into WaterSMART and new funding criteria were established for the program. See Pages 15 – 21.

## About this Report

Over the last seven years, Interior and its partners have been working to address near-term and immediate water shortages, and also to plan for longer-term needs, through WaterSMART. The following chapters highlight the steps taken to date under the major programs being carried out as part of WaterSMART. Each chapter includes a short description of the program, a brief progress update, and a closer look at some of the specific actions that have been taken since 2010 under the program. Each chapter also includes an introduction to the additional information available online as part of the interactive data visualization tool that accompanies this report. The final chapter is a look forward, including a brief summary of additional program elements recently implemented or planned for 2017.

2010

2011

2012



In 2009, as part of the implementation of the SECURE Water Act, Reclamation established the Basin Study Program as part of WaterSMART to provide support for collaborative climate adaptation planning. See pages 7 – 13.

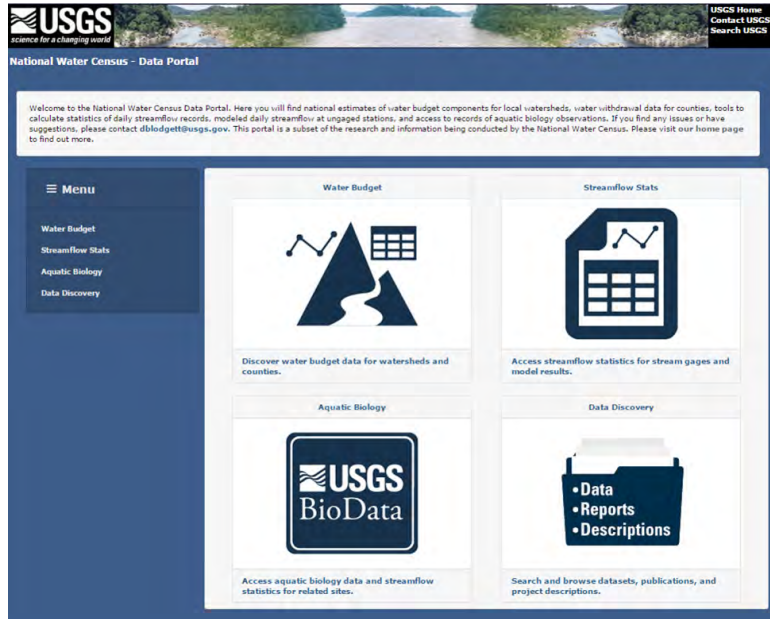


In 2010, building on existing grant programs, Reclamation established WaterSMART Grants to make funding available for water conservation and efficiency improvements in the West. See pages 23 – 29.



In 2012, Interior released a WaterSMART Three-Year Progress Report.





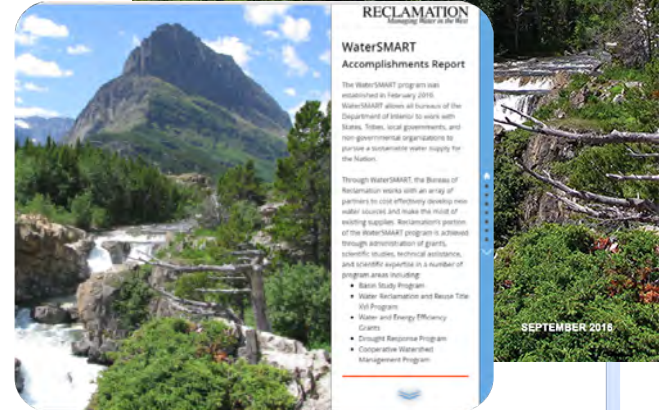
The USGS National Water Census Data Portal allows users to access a comprehensive and nationally consistent interactive map interface for national estimates of water budget components for local watersheds, water withdrawal data for counties, as well as tools and records for streamflow and aquatic biology observations. See pages 49 – 57 on the USGS Water Availability and Use Science Program.

2013

2014

2015

2016



In 2016, the WaterSMART Progress Report 2010-2016 and companion data visualization tool were released highlighting program accomplishments and allowing users to view and interact with program specific information for WaterSMART.



In 2012, Reclamation launched the Cooperative Watershed Management Program to provide funding to watershed groups to form local solutions to address their water management needs. See pages 41 – 47.



In 2015, Reclamation implemented the new Drought Response Program to support a proactive approach to preparing for and addressing drought. See pages 33 – 39.





## WaterSMART Basin Study Program

Good resource management relies on accurate and complete information. We cannot successfully manage our water resources without understanding water supply, current demands for all uses, and future trends, risks, and uncertainties. Science has and will continue to inform the real-time decisions of water managers who need reliable estimates of current conditions in the hydrologic cycle and projections of supply and demand in watersheds throughout the Nation.

The President's Climate Action Plan emphasizes the importance of providing open government data that “can fuel entrepreneurship, innovation, scientific discovery, and public benefits.” Federal, State, and local government managers and water resource associations all recognize that they need more and better water data and improved water science – an important aspect of which is the need for improved analytical approaches that will contribute to new, adaptive strategies for management.

*By using the best available science, Reclamation accomplishes important water resource management objectives:*

- *First, it provides information that is difficult for individual water managers to obtain, with the highest degree of certainty in what is often an uncertain world.*
- *Second, it continues to push the goal higher for better management of precious water resources.*
- *Third, it supports collaborative partnerships that bring people together to understand scientific challenges and develop solutions.*



*Sunrise along the Laguna Reach of the Colorado River near Yuma, Arizona.  
Photo by Alexander Stephens, Reclamation*

## Basin Studies

*Basin Study eligibility includes States, tribes, water districts, cities, and other local governmental entities with water delivery or management authority located in the western United States are eligible to apply for a Basin Study. Any non-Federal entity can contribute to a Basin Study as a cost-share partner, and all stakeholders in a basin where there is a Basin Study are encouraged to participate in the study.*

## West-Wide Climate Risk Assessments (WWCRA)

*Reclamation coordinates with other Federal agencies through the WWCRA Implementation Team to sustain active communication on science tools and data for water resources planning and operations. Non-Federal entities, such as universities or state agencies can access data and information produced through WWCRA and also collaborate in the WWCRA activities to transition science to application.*

## Landscape Conservation Cooperatives

*Reclamation coordinates with partners (Federal, State, local, Tribes, universities, and non-governmental organizations) through LCC Steering Committees and working groups to collaboratively define and develop priority science and tools for managing natural and cultural resources across large landscapes. Partners can be involved at multiple levels and can find out more by contacting the LCC Coordinator in their region. See a map of the LCC Network:*

<https://lccnetwork.org/map>.

# WaterSMART Basin Study Program Activities

Sustainable water management requires understanding and planning for changes in the future. Taking advantage of the program authority established by Congress through the SECURE Water Act, the Secretary of the Interior included a comprehensive climate adaptation program as part of WaterSMART. The WaterSMART adaptation planning strategy consists of several programs designed to help Interior and its partners assess risks to water supplies and ecological resources and identify adaptation strategies. The three activities described in this chapter form the WaterSMART Basin Study Program: Basin Studies, West-Wide Climate Risk Assessments, and Landscape Conservation Cooperatives.

**Basin Studies:** Through Basin Studies, Reclamation works with States, Tribes, non-governmental organizations, other Federal agencies, and local partners to identify strategies to adapt to and mitigate current or future water supply and demand imbalances, including the impacts of climate change and other stressors on water and power facilities. Basin Studies use and develop data, models, and analyses to identify consensus-based solutions to help stakeholders plan for long term water sustainability in the Western United States.

**West-Wide Climate Risk Assessments (WWCRA):** WWCRA are technical evaluations of west-wide climate-induced risks and evaluations of impacts to Reclamation's operations. Key data on climate-induced risks and impacts developed through the WWCRA provides a foundation for future Basin Studies as well as for project-specific applications. WWCRA also generate important information, tools, and guidance that support the integration of climate information into planning activities, consistent with Reclamation's Climate Change Adaptation Strategy.

**Landscape Conservation Cooperatives (LCC):** The LCCs are collaborative partnerships of governmental (Federal, State, tribal, and local) and non-governmental entities. The 22 LCCs collectively form a network of resource managers and scientists who share a common need for scientific information and interest in conservation throughout the U.S. and parts of Canada, Mexico, and the Pacific Islands. The primary goal of the LCCs is to provide science and technical support, coordination, and communication to resource managers to inform strategies for adapting to climate change and other landscape-scale ecosystem stressors. The individual LCCs each function in a specific geographic area. Reclamation co-leads the Desert and Southern Rockies LCCs – which roughly overlie the Colorado River Basin – with the U.S. Fish and Wildlife Service (USFWS).

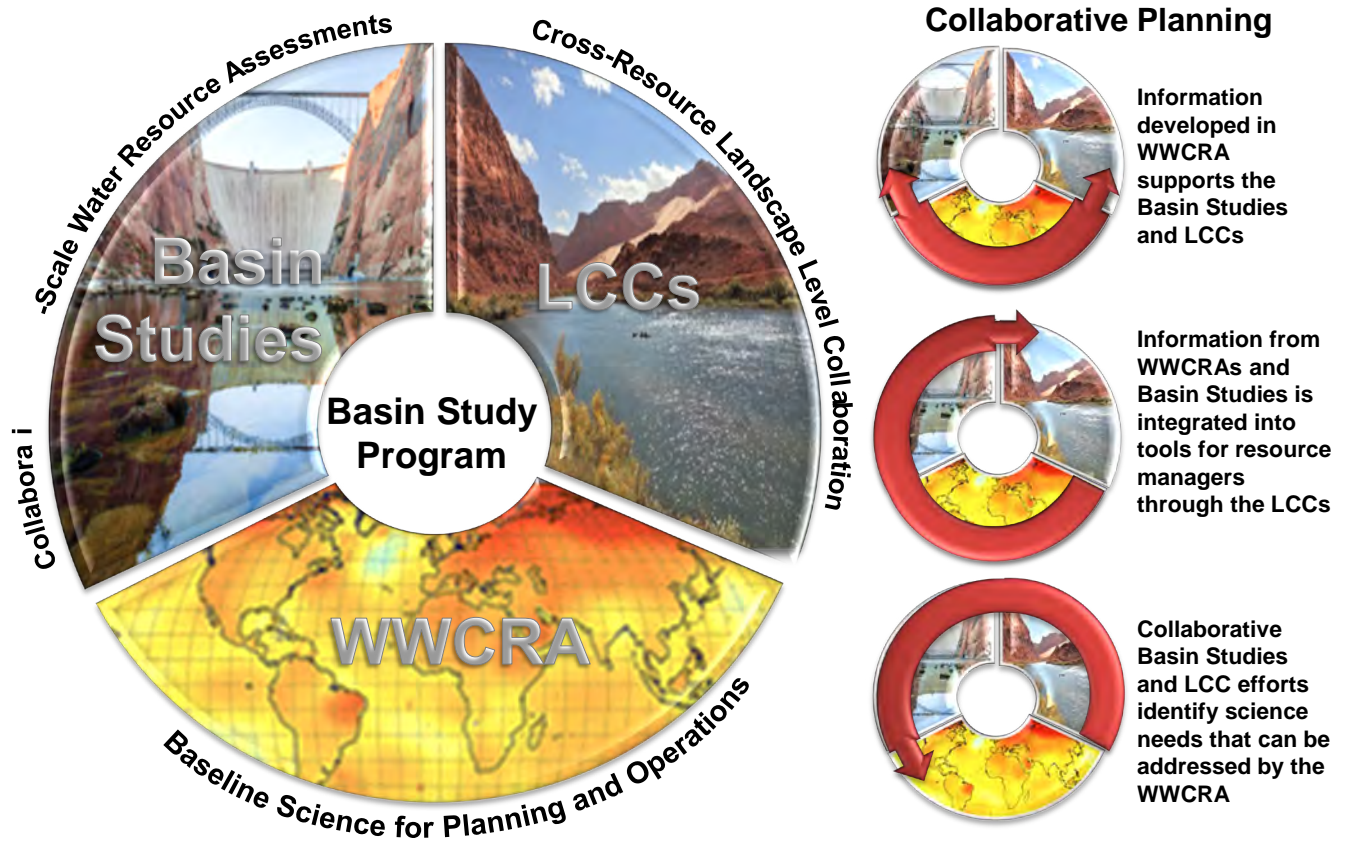


These activities are complementary and represent a comprehensive approach to the assessment of climate change impacts on Reclamation's mission and the identification of adaptation strategies. Through the WWCRA, Reclamation develops baseline information regarding the risks and impacts of climate change to water supplies and demands, as well as Reclamation's operations. The information developed through the WWCRA is used in Basin Studies to work collaboratively with stakeholders to evaluate the ability to meet future water demands and identify mitigation and adaptation strategies. Reclamation also shares the information developed through WWCRA and Basin Studies with resource managers through the LCCs, which are partnerships focused on developing management strategies across multiple resource areas, including water, lands, species, and ecosystems. Collaboration with partners through the LCCs and Basin Studies, in turn, helps to identify science needs and gaps that can be addressed by the WWCRA.

*Together, these activities form a robust program that utilizes Federal and stakeholder driven activities to assess risks from climate change and other stressors and identify adaptation strategies that implement Reclamation's [Climate Change Adaptation Strategy](#) and the [SECURE Water Act](#).*

## Collaborative Planning in the Basin Study Program

*Collectively, the Basin Study Program supports collaborative planning through inter-related activities, where WWCRA contribute baseline science for planning and operations, the Basin Studies provide collaborative, basin-scale water resource assessments, and the LCCs support cross-resource landscape level collaboration.*



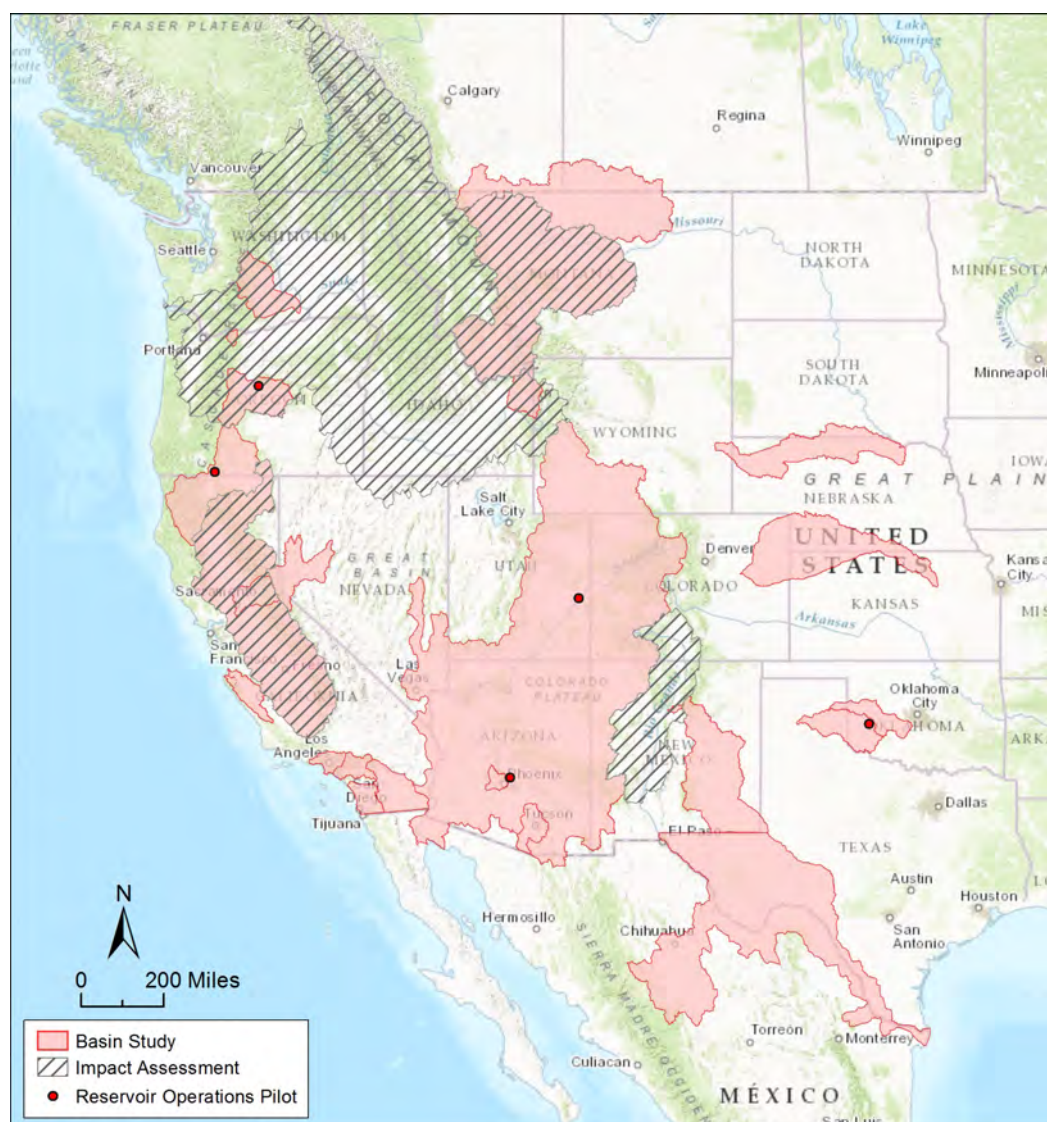
*WaterSMART Data Visualization Tool Map of the WaterSMART Basin Studies, Impact Assessments, and Reservoir Operations Pilots from 2010 – 2016 below and the LCC Projects from 2010 – 2016 on the right. Click on a project for more information.*

<http://arcg.is/1TcT68S>

## Program Update

WaterSMART Basin Studies are an important mechanism to identify adaptation strategies appropriate for the area being studied. As collaborative studies that are cost-shared with non-Federal partners, Basin Studies evaluate the impacts of climate change and identify a broad range of potential strategies to address water supply and demand imbalances, both current and future. Since 2009, Reclamation has initiated 34 studies in 15 western states. These studies include 25 Basin Studies, 4 WWCRA regional climate impact assessments to assess climate impacts in a river basin, and 5 reservoir operations pilot studies to evaluate improvements to reservoir operations.

*Note: Study areas that span international boundaries, such as the Columbia River Basin Climate Impact Assessment and Lower Rio Grande Basin Study, included an assessment of the watershed hydrology that contributes to water supply in the basin from Canada and Mexico, respectively.*



By building a network that is holistic, collaborative, adaptive, and grounded in science, LCCs are working to ensure the sustainability of our economy, land, water, wildlife, and cultural resources. Reclamation and the USFWS co-lead both the Desert and Southern Rockies LCCs, which have funded 44 projects since 2009 to develop tools and science that analyze and address climate change impacts.

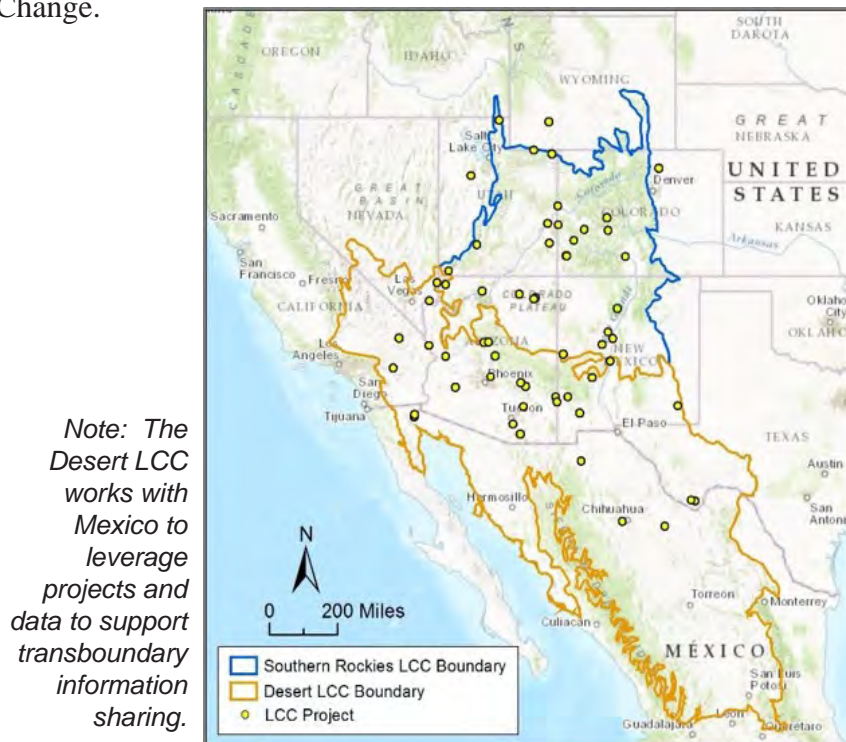


Funding provided by the Desert and Southern Rockies LCCs support mutual climate adaptation efforts by:

- Convening cross-jurisdictional, multi-sector partners
- Assessing current and future landscape conditions
- Modeling and mapping landscape configurations that meet conservation goals
- Identifying strategies to implement actions in specific places to meet conservation goals
- Providing science that supports priorities and landscape assessment
- Communicating priorities, needs, and results across landscapes

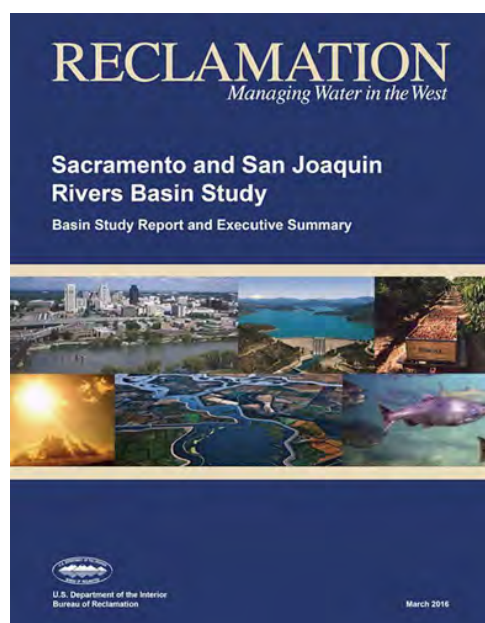
The Desert LCC geography includes the Mojave, Sonoran, and Chihuahuan Desert regions of the southwestern United States and northern Mexico. The Desert LCC is leading collaborative efforts with partners in Mexico by leveraging projects and data to support transboundary information sharing. In 2014, the Desert LCC funded an effort to integrate water delivery data and models on habitat and species responses to the Minute 319's environmental water deliveries to the Colorado River Delta. This project creates a user-friendly tool for predicting the hydrologic and ecological responses to pulse flows released into the Colorado River Delta under varying climate conditions in a rapid, unified manner to assist decision makers from both the U.S. and Mexico as they consider the results achieved under Minute 319 to inform future binational negotiations.

Activities funded under the Basin Study Program contribute to Reclamation's implementation of Section 9503 of the SECURE Water Act and to meeting Interior's Priority Goal for Climate Change.



### *Did you know?*

- *By the end of the century, due to changing snowpack conditions summer streamflow is expected to decrease by 7 to 27% in several river basins, including the Colorado, the Rio Grande, and the San Joaquin, where snowpack accounts for a significant portion of the storage and water supply in the basin.*
- *Earlier springs and warmer summers are beginning to severely restrict trout habitat in the headwater streams of the Rocky Mountains.*
- *The impacts of climate change are affecting fire danger and frequency in sensitive riparian habitats in the Southwest.*
- *Many Basin Studies evaluate portfolios of multiple possible adaptation strategies. Rarely will one single strategy be sufficient to address all of the potential impacts of concern.*
- *Reservoir operation pilots are critical to understanding where flexibilities in reservoir operations may be increased through improved use of weather forecasting and also support the National Drought Resilience Partnership.*
- *Research funded by the LCCs has been used to develop tools to help understand climate change impacts to riparian ecosystems and to identify critical riparian areas for restoration.*



*“The Sacramento-San Joaquin Basin Study was a great collaborative process between Reclamation, State, and local agencies. This Basin Study provides a framework for evaluating uncertainties impacting future water supplies and water demands, including climate change and population growth, and identifies ways for improving future water management conditions. The coordination on the Basin Study helps local agencies work with Federal and State agencies and others to provide a path forward for water supply reliability.”*

Rich Jurich, Principal Water Resources Engineer, State of California Department of Water Resources

## Featured Projects

These examples highlight the type of work that is conducted under the program and include select Basin Studies, WWCRA climate impact assessments, and landscape level projects.

In 2016, Reclamation released the **Sacramento and San Joaquin Rivers Basin Study**, which found that climate change will cause earlier runoff, declines in snowpack, and higher sea levels, potentially affecting reservoir operations and water storage, increasing unmet water demands, and increasing salinity levels. This study, collaboratively developed by Reclamation, the State of California Department of Water Resources, El Dorado County Water Agency, Stockton East Water District, California Partnership for the San Joaquin Valley and Madera County Resource Management Agency, examined climate change impacts and adaptation actions for the Sacramento River Basin, San Joaquin River Basin, and the Tulare Lake Basin. Basin Study partners and stakeholders developed an array of potential water management actions to address future water related risks.

In 2015, Reclamation released the **Santa Fe Basin Study**, which found that without implementing adaptation strategies, there will be a water supply and demand imbalance of about 7,375-9,323 acre-feet per year by 2055 due to the impacts of population growth and climate change. The Santa Fe Basin Study was collaboratively developed by Reclamation, the City of Santa Fe, and Santa Fe County. The area’s population is expected to increase about 80 percent by 2055 and, unless action is taken, would be expected to result in a shortfall of about 5,155 acre-feet of water per year (more than 20% of the area’s current demands)--even without the impacts of climate change. The portfolio of strategies identified in the study includes using reclaimed water, water conservation, direct injection and infiltration for aquifer storage and recovery, and obtaining additional water rights.

In 2016, Reclamation also released the **WWCRA Columbia River Basin Impact Assessment**, a reconnaissance-level assessment of the potential hydrologic impacts of climate change in the Columbia River Basin. The basin is in the Pacific Northwest region and extends over seven States, 13 federally recognized Indian reservations, and southern British Columbia, Canada. The impact assessment is currently being used to provide scientific information to the water management community for a number of planning projects including the Hungry Horse Power Plant modernization, a preliminary hydrologic evaluation of a dam raise at Anderson Ranch Reservoir, and the Boise General Investigation.



The **Southern Rockies LCC** is building tools that predict long-term extreme climate conditions, such as prolonged drought, to help manage water supply in the Intermountain West. In 2015, researchers developed a reconstructed record of streamflows by combining climate modeling with local drought histories (developed from tree-ring reconstructions) to project future water availability. Partners are already using these data and tools to plan for changes in water management and operations necessary to adapt to climate change. The project is being developed collaboratively with partners such as the Weber Basin Water Conservancy District, Metropolitan Water District of Salt Lake and Sandy, Salt Lake Department of Public Utilities and the Provo River Water Users Association.

In the past decade there has been increased interest in providing water to meet the needs of riparian and aquatic ecosystems in the Western United States. Projected water deficits mean that land and water managers must be proactive in managing rivers and shallow aquifers to maintain these ecosystems. The **Desert LCC** is funding a **Desert Flows Database** for managers and decision makers to provide easy access to the best techniques available for determining how much water ecosystems need. The [Desert Flows Database](#) summarizes key data from over 400 studies on environmental flows from across the desert watersheds of the U.S. and Mexico and provides users with a one-stop-shop for published information. This project further identifies critical data gaps in flow need and flow response information.



## Study: 'Megadroughts' coming to Utah, much of West

FRIDAY, FEBRUARY 13, 2015 - 8:27 AM



BRIANA SCROGGINS

Source: *Standard-Examiner*,  
February 13, 2015.

*The Desert Flows Database combines data from 408 sources to provide a one-stop shop for managers looking for information on water flow needs for ecosystems and environmental responses.*

*International cross-boundary collaboration demands a new understanding about how to share information through networks, like LCCs, that are increasingly sharing data across all jurisdictions and geographical boundaries to build a comprehensive picture of the climate impacts and our environments.*

*Rio Grande, Texas at  
Big Bend National Park.  
Photo by Genevieve Johnson,  
Reclamation Desert LCC  
Coordinator.*





## Title XVI Water Reclamation and Reuse Program

Water reuse and recycling can turn currently unusable water sources into a new source of water supply that is less vulnerable to drought and climate change. Throughout the country, wastewater effluent from households and commercial and industrial facilities is collected at wastewater treatment plants where it is treated prior to disposal. Most of those wastewater treatment plants accomplish “primary” treatment (removal of suspended solids and organic matter) and “secondary” treatment (further biological treatment and disinfection) before discharging treated wastewater into streams or rivers, or into the ocean.

Water management agencies can stretch existing drinking water supplies and help to ensure that growing water needs can be met through advanced treatment of wastewater and naturally impaired surface and groundwater. In particular, in communities where downstream users are not already relying on that treated wastewater as part of their water source, reuse of wastewater can become an additional supply as well as a way to reduce discharges into particularly sensitive ecosystems.

*Many WaterSMART Basin Studies identify the use of non-traditional water supplies as an adaptation option to plan for future water supply imbalances. For example, the Lower Rio Grande Basin Study in Texas, identified regional brackish groundwater desalination as an adaptation strategy capable of meeting future municipal demands.*

*Indirect Potable Reuse system at the North City San Diego Recycling Plant. Photo by Alexander Stephens, Reclamation.*





## Authorized Projects

**Eligible Applicants:** Sponsors of water reclamation and reuse projects specifically authorized for funding under Title XVI of Public Law 102-575

**Federal Funding and Non-Federal Cost Share:** The average annual Federal funding allocation is \$3 million per applicant with a non-Federal cost share of 75% or greater.

## Feasibility Studies

**Eligible Applicants:** Entities with water delivery authority, all located within the 17 Western States or Hawaii.

**Federal Funding and Non-Federal Cost Share:** Federal funding up to \$150,000 per study, or up to \$450,000 per study for larger or regional-scale studies, with a cost share of 50% or greater.

## Research Studies

**Eligible Applicants:** Entities with water delivery authority, all located within the 17 Western States or Hawaii.

**Federal Funding and Non-Federal Cost Share:** Federal funding up to \$75,000 for planning related research, \$150,000 for research at existing facilities, and \$300,000 for research at new locations with a cost share of 75% or greater.

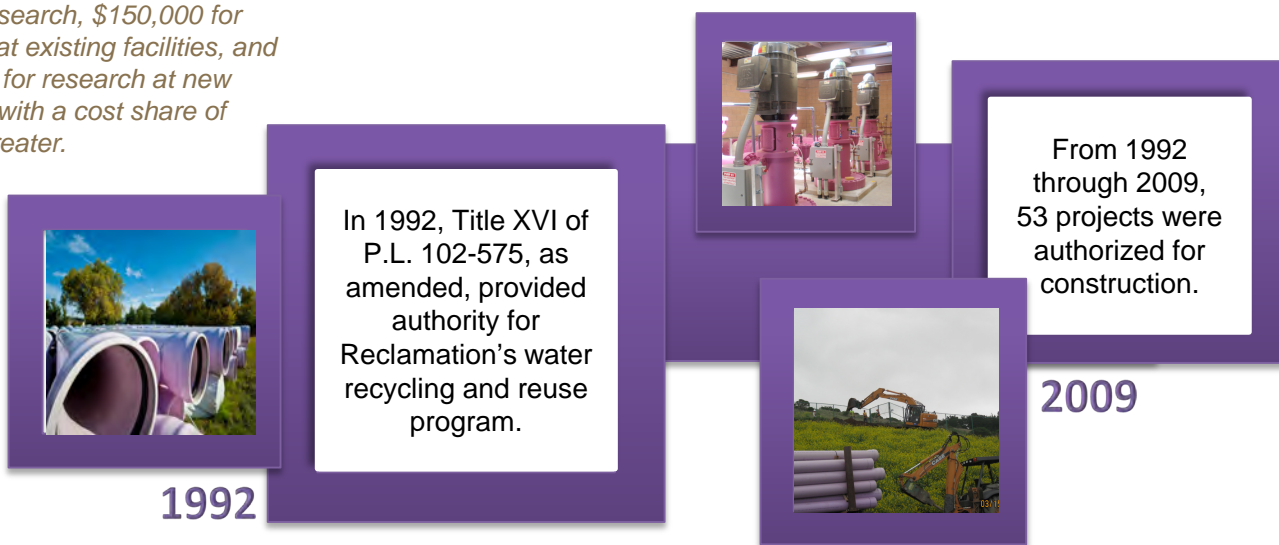
# WaterSMART Title XVI Program

In 1992, to implement Title XVI of Public Law 102-575, Reclamation established a program to address reuse of municipal wastewater, agricultural wastewater, and naturally impaired groundwater or surface waters. Through the WaterSMART Title XVI Water Reclamation and Reuse Program, Reclamation works with water management agencies in the Western U.S. and Hawaii as they plan, design, and construct water reuse projects. Funding is provided annually through funding opportunity announcements:

**Authorized Projects:** Funding is provided to sponsors of congressionally authorized Title XVI Water Reclamation and Reuse projects to plan, design or construct their projects. Congress specifically authorizes Reclamation to participate in the construction of these particular projects. Since 1992, 53 projects have been specifically authorized under Title XVI.

**Feasibility Studies:** Through the program, funding is also provided for communities in the West which may be seeking new sources of water supplies using water recycling and reuse technologies. Funding for feasibility studies assists communities in determining whether water recycling and reuse projects are viable opportunities for them.

**Research Studies:** In 2016, Reclamation provided a new funding opportunity for water entities in the Western U.S. to conduct water reclamation research under the Title XVI Water Reclamation and Reuse Program for planning related research, research to improve existing facilities, and research to advance state of the art technology deployment at new locations.



## Timeline of Reclamation's Title XVI Program from 1992 through 2016.

2016

Congressionally authorized Title XVI projects together have a maximum estimated capacity of about 738,000 acre-feet per year at build out.

In 2016, Reclamation offered the first funding opportunity for research studies under Title XVI to support planning related research.



2015

In 2015, Title XVI projects delivered over 369,000 acre-feet of water in the Western U.S. In 2016, projects are projected to deliver over 400,000 acre-feet.



To date, more than \$667 million in Federal funding through the Title XVI program has been awarded and is being leveraged with non-Federal funding to implement more than \$3.3 billion in improvements.

2011

In 2011, Reclamation offered the first funding opportunity for feasibility studies under Title XVI to support planning for new water reuse opportunities.



The 36 Title XVI projects in California have capacity to recycle more than 660,000 acre-feet of water per year—about 300,000 acre-feet per year beyond current production.



In 2010, the Title XVI Program was incorporated into WaterSMART, where program criteria and a competitive process were developed to award Title XVI funding.

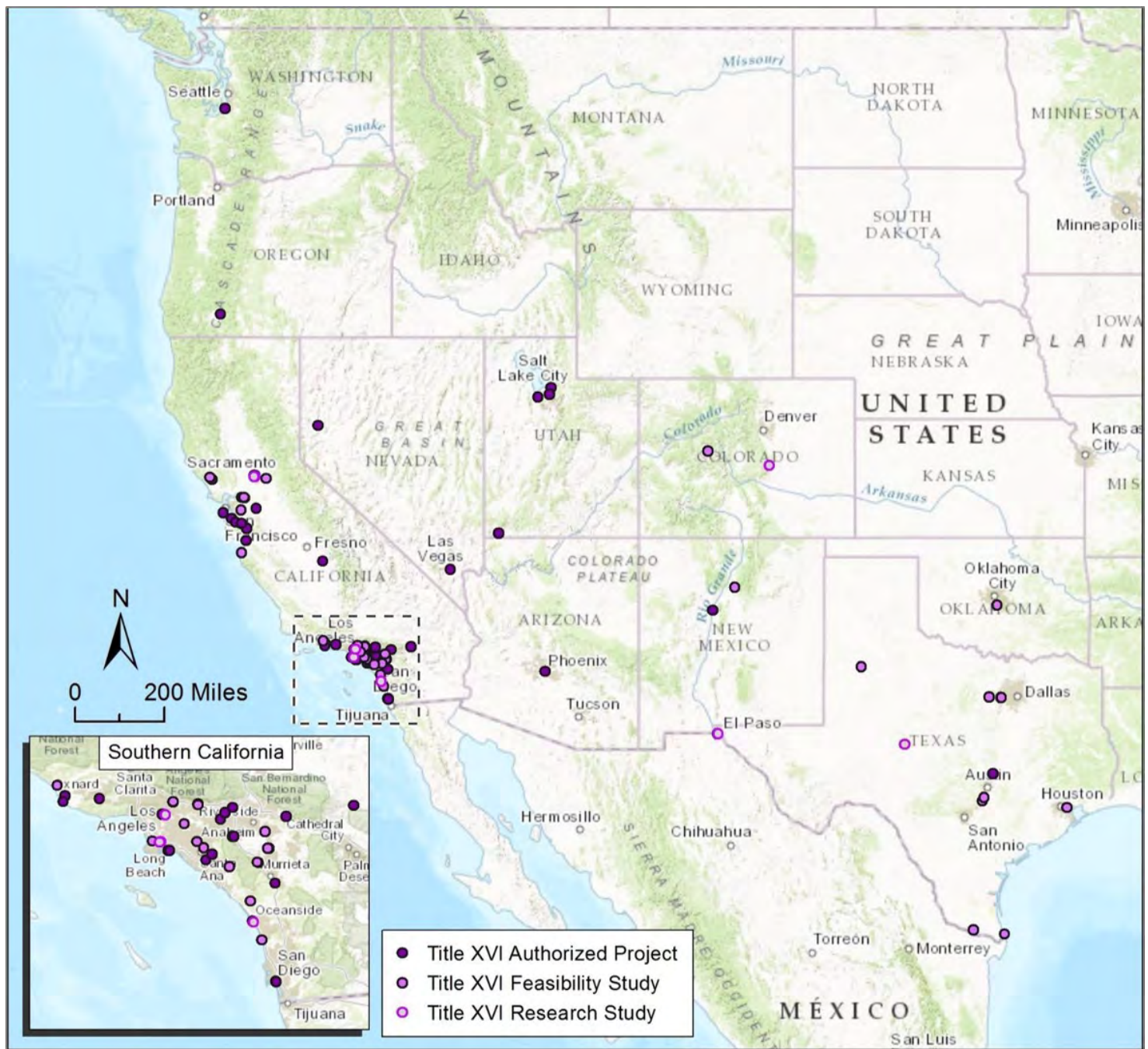
2010

*WaterSMART Data Visualization Tool Map of the WaterSMART Title XVI Program grants from 2010 – 2016. Authorized projects, feasibility studies, and research studies are represented by different shades. Click on a project for more information.*

<http://arcg.is/1TcT68S>

## Program Update

Since 2009, the WaterSMART Title XVI Program has provided funding for research, planning, design, and construction in 7 states through more than 75 grants for research, feasibility studies, and construction projects. To date, approximately \$667 million in Federal funding through the Title XVI program has been awarded and is being leveraged with non-Federal funding to implement more than \$3.3 billion in water reuse improvements.



Note: Map includes Title XVI projects authorized since the inception of the Title XVI Program 1992.



Title XVI projects provide growing communities with new sources of clean water while promoting water and energy efficiency and environmental stewardship. Projects completed through the program can improve efficiency, providing flexibility and diversifying the water supply. Reuse is often a drought-resistant supply, since sources such as treated municipal wastewater continue to be available during periods of water shortages. Imbalances between water supply and demand are expected to increase in many parts of the country as population grows and water shortages becomes more prevalent due to climate change and droughts. These challenges may lead more and more communities to turn to water reclamation and reuse as an opportunity to expand water supplies.

- Since 2010, Reclamation has provided funding for approximately 36 authorized construction projects under the program.
- Twenty-four congressionally authorized projects have now finished construction.
- Reclamation has also funded more than 30 water reuse feasibility studies in five Western States through funding opportunities provided in 2011, 2012, 2014, and 2015.
- In 2016, nine research studies were funded under the newest aspect of the program, which focuses on research to advance the technology associated with water reclamation.

Title XVI is an important part of Interior's Climate Action Plan and Reclamation's Climate Change Adaptation Strategy under key goals such as increasing water management flexibility and enhancing adaptation planning. Title XVI continues planning efforts, where water reuse is identified as a strategy to mitigate climate change impacts, which include drought, fire, ecosystem resiliency, and water quality.

### *Did you know?*

*Water recycling has been actively managed in the U.S. since the 1970s. For instance, Orange County, California has used water reuse for managed aquifer recharge since 1976.*

*In 2014, Big Spring, Texas completed the first direct potable reuse facility in the United States.*

*According to the University of Arizona's Water Resources Research Center, between 60 and 65% of the water that goes down a home's drain could be reused.*

*A 2012 National Academy of Sciences study found that U.S. coastal cities could increase their water supply by 27% with treated wastewater.*



*As a next step to the Santa Fe Basin Study, the City of Santa Fe, New Mexico, is conducting a water reuse feasibility study to develop greater resiliency and diversity in their water portfolios by exploring alternatives for reclaimed wastewater. For more information on this study, check out the Title XVI featured projects.*



*Construction (above) and the completed (below) 100 acre-foot capacity recycled water reservoir by the Sonoma Valley County Sanitation District, part of a Title XVI project to reduce reliance on groundwater supplies. Photos courtesy of North Bay Water Reuse Authority, all rights reserved, 2016.*



## Featured Projects

Through the Title XVI Water Reclamation and Reuse Program, Reclamation works with water management agencies in the Western U.S. and Hawaii as they plan, design, and construct water reuse projects. Projects highlighted below include select construction projects and feasibility studies funded through the program.

In 2016, the **North Bay Water Reuse Project** in Santa Rosa, California, is constructing Phase I of the project, which includes upgrades of treatment processes and construction of storage, pipelines, and pump station facilities to distribute recycled water. Phase I will provide 5,457 acre-feet of recycled water annually for agricultural, environmental, industrial, and landscape uses throughout Marin, Sonoma, and Napa counties. The project reduces reliance on local and imported surface water and groundwater supplies, and it reduces the amount of treated effluent released to San Pablo Bay and its tributaries.

Other Title XVI projects that have been completed in California include the **Watsonville Area Water Recycling Project** in Watsonville, California that provides 4,000 acre-feet of recycled water per year for irrigation. This project reduces overdrafting of groundwater resources and subsequent seawater intrusion. In southern California, the **Orange County Water District and Orange County Sanitation District** jointly constructed the Groundwater Replenishment System, which underwent an expansion in 2015 and now produces 103,000 acre-feet of advanced purified water each year.



*Water recycling and reuse offsets the demand for imported water in Southern California, such as the diversion of Colorado River Water through the All-American Canal. Reclamation photo.*



Also in southern California, the **Irvine Basin Project** employs a natural treatment system that uses wetlands to remove contaminants from urban drainage facilities and treats brackish groundwater to produce approximately 13,300 acre-feet of water annually.

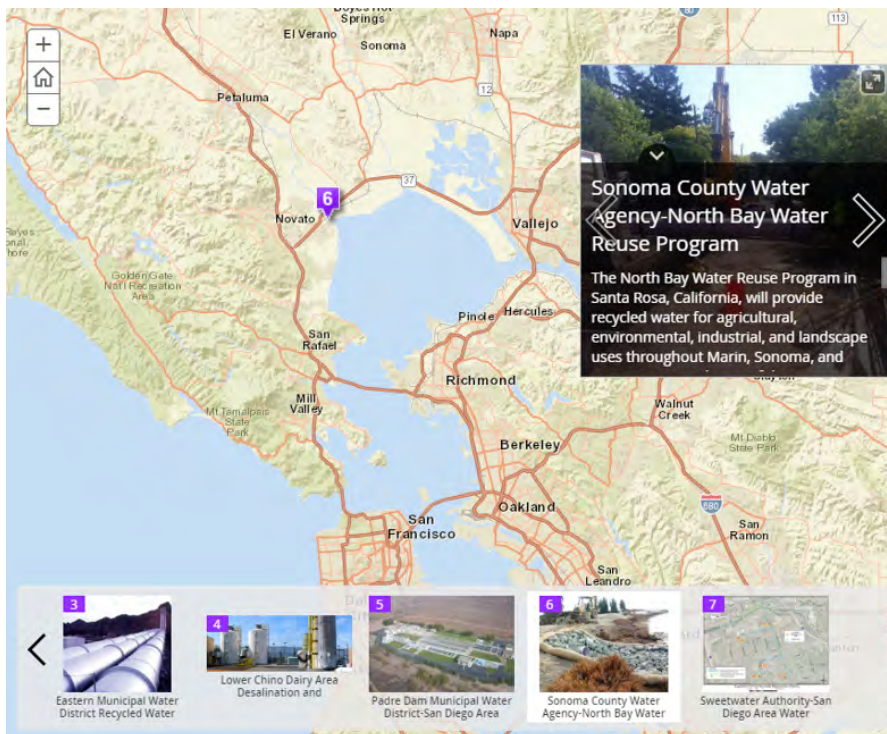
In Texas, the **City of Round Rock's** new facilities perform additional treatment of municipal wastewater so that recycled water can be delivered to parks and schools for irrigation. The project has the capacity to provide 13,400 acre-feet annually, which is 10% of its projected 2050 demands.

Located along the Texas Gulf Coast, the **Laguna Madre Water District** evaluated alternatives to reuse 784 acre-feet of effluent annually from the Port Isabel Wastewater Treatment Plant to improve of water supply reliability for urban irrigation and potable purposes in the district.



*Port Isabel along the Texas Gulf Coast was the focus area of the Laguna Madre Water District's Title XVI Feasibility Study.*

The **City of Santa Fe**, New Mexico, with input from Santa Fe County, is conducting a feasibility study to evaluate alternatives for both potable and non-potable applications of reclaimed water to augment local water supplies. The study is developing options with greater resiliency to drought that will produce 4,000 acre-feet of water per year. This study is a next step after the Santa Fe Basin Study, which identified water recycling as a potential climate adaptation strategy.



*Take a tour around the west to view featured Title XVI projects in the WaterSMART Data Visualization online.*

<http://arcg.is/1TcT68S>

*Title XVI is an important part of WaterSMART and is used to provide communities with a new source of clean water, while promoting water and energy efficiency and environmental stewardship. For more information on the WaterSMART Title XVI Program visit the website:*

<https://www.usbr.gov/watersmart/title/index.html>.



## WaterSMART Grants

Most Western States incorporate water conservation and efficiency into their plans to ensure that water is available to meet demands into the future. The State of Texas plans to work toward increasing conservation and efficiency by about 1.5 million acre-feet of water per year by 2060, a volume that represents roughly 23% of the State's strategy to meet expected future demands. The State of California has set a goal of a 20% reduction in urban water use by 2020 and is currently finalizing regulations to implement goals and best practices for agricultural water conservation.

*Competitive, cost-shared funding for non-Federal partners' water conservation and efficiency improvements is a fundamental aspect of WaterSMART.*

WaterSMART Basin Studies have identified demand management as a crucial adaptation action that can be considered to address vulnerabilities related to drought and climate change. Improvements that reduce the demand for water, particularly during periods of water scarcity, can provide valuable flexibilities by helping to bring those demands into better balance with supply. With water deliveries in the West facing increasing vulnerabilities from population growth and climate change, various strategies to ease demands are being implemented by communities across the Western United States. These strategies include improved water conservation and efficiencies in water and energy use.

### Water Conservation and Climate Change

**Water Conservation and Climate Change Projects funded through WaterSMART Grants address climate adaptation, bolstering Reclamation's contributions to two pillars of the President's 2013 Climate Action Plan: (1) Cut Carbon Pollution in America; and (2) Prepare the United States for the Impacts of Climate Change. Climate change requires a more efficient use of limited water resources. Projects funded through WaterSMART Grants and carried out by non-Federal entities are adaptation actions that can help to ensure that water is available to meet demands into the future. The President's Climate Action Plan highlights Reclamation's efforts through WaterSMART Grants to provide funding to agricultural water users for more efficient practices in the face of drought and long-term climate change.**



*Drop chute in the St. Mary River Basin. Reclamation photo.*



## **Water and Energy Efficiency Grants**

**Eligible Applicants:** States, Tribes, irrigation districts, water districts, or other organizations with water or power delivery authority in the Western United States.

**Federal Funding and Non-Federal Cost Share:** Federal funding up to \$300,000 for projects to be completed within two years; or up to \$1,000,000 for projects to be completed within three years with a cost share of 50% or greater.

*Through 2016, WaterSMART Water and Energy Efficiency Grants has been the primary category of WaterSMART Grants. Beginning in 2017, Reclamation is introducing two new grant categories. One new category will focus on water marketing projects, while the other will focus on small-scale implementation projects. Please see pages 60 – 61 for additional information.*

## **WaterSMART Grants**

Through WaterSMART Grants, Reclamation provides cost-shared funding on a competitive basis to non-Federal partners to implement water and energy conservation and efficiency projects. Projects that can be completed within two or three years are selected through a competitive process to help increase the sustainability of water supplies in the Western United States.

Water and Energy Efficiency Grants, the primary category of funding under WaterSMART Grants, focus on projects that result **in quantifiable and sustained water savings**, including canal lining and piping projects, irrigation flow measurement, and groundwater recharge projects.

Projects that increase the use of **renewable energy** in the management and delivery of water are also eligible for funding, including projects to install small-scale hydroelectric, solar-electric, wind energy, and geothermal power systems at existing water delivery facilities. Criteria place a priority on projects that dedicate conserved water to **in-stream flows** to benefit federally listed species or result in other fish and wildlife benefits, that implement an adaptation strategy identified in a completed **WaterSMART Basin Study**, and that will also expedite **future on-farm irrigation improvements**, including those that may be eligible for NRCS funding.

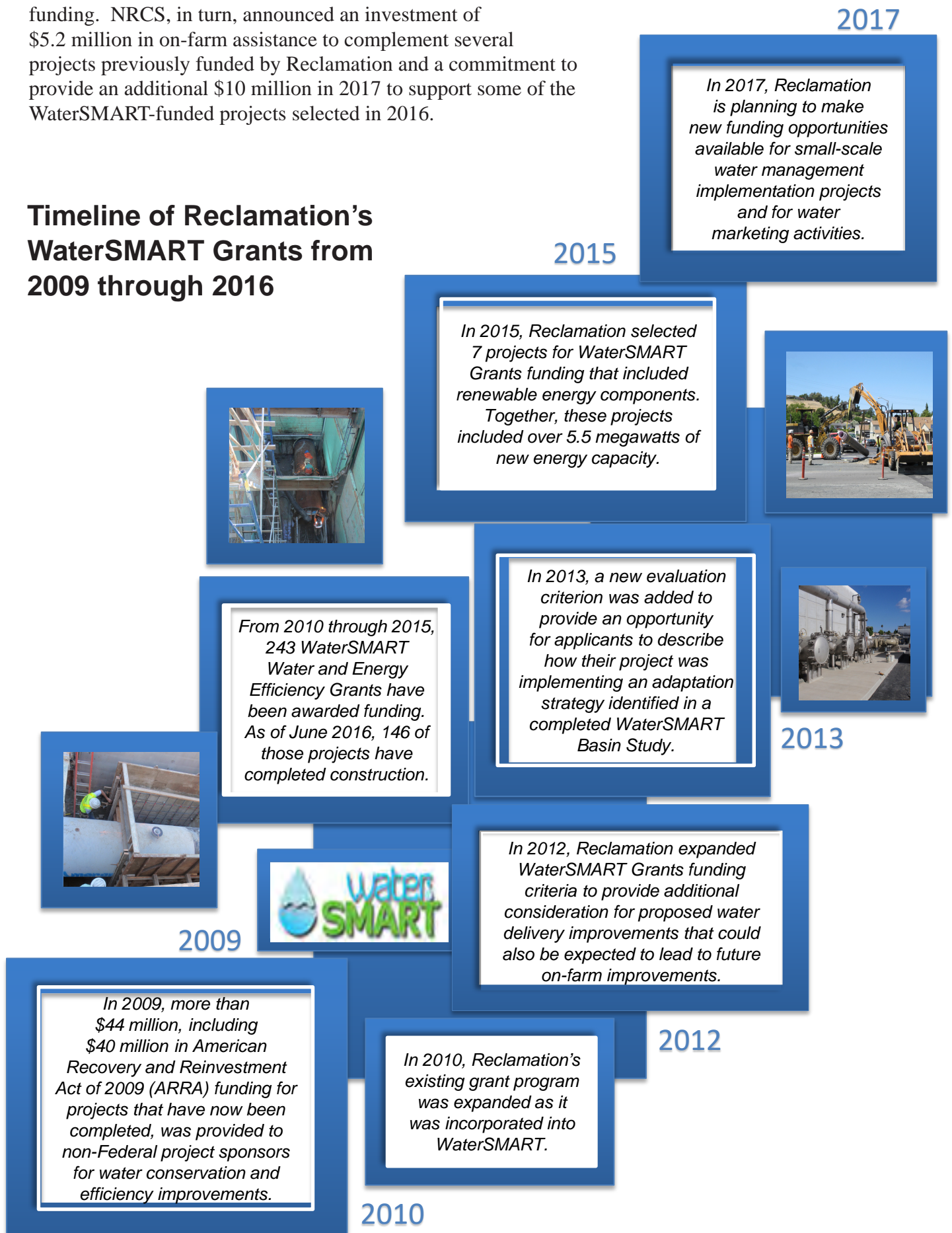
## **Collaborative Water Conservation Partnership with NRCS**

Reclamation and NRCS are coordinating efforts to address water management improvements that increase water supply sustainability. In 2012, building on a partnership between the two agencies in California, Reclamation expanded WaterSMART Grants funding criteria to provide additional consideration for projects that not only address sustainability through water delivery system improvements, but that could also be expected to lead to future on-farm improvements. Once projects have been selected for WaterSMART Grants funding, NRCS reviews the list of projects to identify any opportunities to make funding available to agricultural producers to carry out complementary on-farm irrigation improvements.

The President's March 2016 Memorandum on Building National Capabilities for Long-Term Drought Resilience commits to expanding this collaborative effort. In June 2016, Reclamation Commissioner Estevan López and Agriculture Secretary Tom Vilsack made a joint funding announcement to highlight the commitment to this partnership. Reclamation announced 53 new WaterSMART Grants projects to receive \$25.6 million in

funding. NRCS, in turn, announced an investment of \$5.2 million in on-farm assistance to complement several projects previously funded by Reclamation and a commitment to provide an additional \$10 million in 2017 to support some of the WaterSMART-funded projects selected in 2016.

## Timeline of Reclamation's WaterSMART Grants from 2009 through 2016





*WaterSMART Data Visualization  
Tool Map of the WaterSMART  
Grants from 2010 – 2016. Click on  
a project for more information.*

<http://arcg.is/1TcT68S>

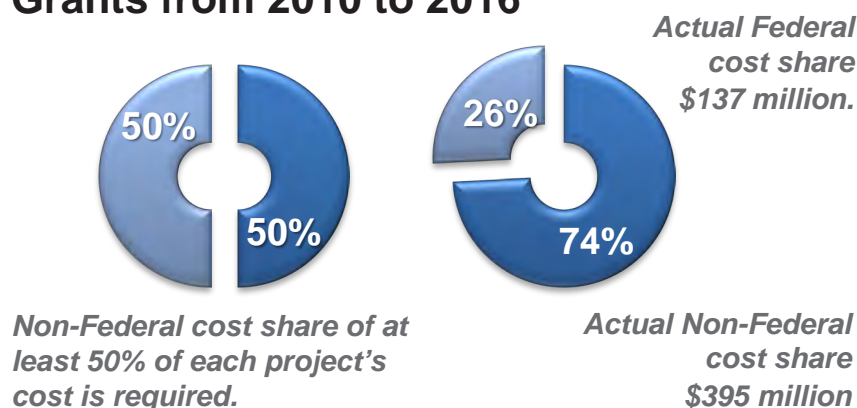
## Program Update

Since 2010, Reclamation has provided more than \$135 million in competitively-awarded WaterSMART Grants to non-Federal partners, including tribes, water districts, and municipalities.





## Leveraging Funding for WaterSMART Grants from 2010 to 2016



*Through WaterSMART Grants, Federal funding (light blue), is leveraged with non-Federal funding (dark blue) to accomplish on-the-ground water management improvements. Over the last seven years, project sponsors have provided much more non-Federal funding than is required, helping to leverage limited Federal funding available through the program.*

WaterSMART Grants leverage funding. Sponsors match Federal funding dollar for dollar on all WaterSMART Grants projects, and many sponsors are able to secure non-Federal funding beyond the required 50% level. Since 2010, more than \$135 million in Federal funding has been used to implement more than \$395 million in water management improvements across the Western United States.

- Since 2010, Reclamation has provided funding through WaterSMART Grants for 243 on-the-ground improvements in 15 Western States.
- In 2016, Reclamation selected 53 projects in 11 Western states to receive a total of \$25.6 million in WaterSMART Grants which, when leveraged with local and other funding sources, will complete more than \$128 million in efficiency improvements.
- Through reduced pumping and adding more efficient equipment, these projects are also anticipated to save 10.8 million kilowatt-hours annually – enough energy to power nearly 1,000 households and equivalent to over 12.5 million tons of avoided carbon dioxide emissions.

Consistent with Reclamation's Climate Change Adaptation Strategy, which recognized a role for Reclamation in helping to increase water management flexibility, WaterSMART Grants make cost-shared funding available to non-Federal partners to carry out water conservation and efficiency projects collaboratively. The grants prioritize projects that implement adaptation strategies identified through Basin Studies. As Basin Studies are completed, water managers look to WaterSMART Grants to help them implement adaptation strategies.

### *Did you know?*

*One acre-foot of water is the volume needed to cover a football field with nine inches of water.*

*One acre-foot of water translates to 325,851 gallons.*

*About 6,800 gallons of water is required to grow a day's food for a family of four.*

*A leaky faucet can waste 100 gallons a day. Household leaks can waste more than 1 trillion gallons annually nationwide. That's equal to the annual household water use of more than 11 million homes.*

## Featured Projects



*Piping project by the Three Sisters Irrigation District and the Deschutes River Conservancy help protect Whychus Creek flows, to meet the Oregon Department of Fish and Wildlife's instream flow target for steelhead and Chinook salmon.*

*Reclamation continues to work with its partners to complete agricultural and municipal and industrial water conservation improvements that implement demand-management strategies. For more information on WaterSMART Water and Energy Efficiency Grants see:*

<https://www.usbr.gov/watersmart/weeg/index.html>

Through WaterSMART Grants, Reclamation provides grant funding to water management agencies to carry out water and energy efficiency improvements, including projects that save water; increase energy efficiency and the use of renewable energy in water management; support environmental benefits (i.e., make conserved water available instream or otherwise address endangered species issues); and mitigate conflict risk in areas with a high risk of future water conflict. Depending on specific needs, entities seek funding for a variety of project types:

For example, the **Three Sisters Irrigation District** in Oregon identified a need to convert open ditches to pipe. Through a 2015 WaterSMART Grant, the district is working to pipe 14,000 feet of the open Watson-McKenzie Main Canal, which is expected to result in water savings of approximately 1,850 acre-feet annually. The District is also working with farmers that are interested in working with the Natural Resources Conservation Service to convert to high efficiency irrigation systems once the pressurized pipe is installed. The District plans to dedicate a portion of the conserved water for instream flows through the Deschutes River Conservancy to improve habitat for endangered species.

Similarly, through a 2012 WaterSMART Grant, the **Bostwick Irrigation District** in Nebraska converted 7 miles of open ditch to buried pipe, an improvement estimated to result in savings of 1,573 acre-feet of water annually that had been lost to seepage and evaporation. The project also included the installation of a variable frequency drive to increase pumping efficiency. Water conserved as a result of this project is stored in the Harlan County Reservoir, on the Republican River to maintain high lake levels, meet water supply needs, and to help comply with the Republican River Compact.

Other types of water management infrastructure improvements are also funded through WaterSMART Grants. In northern Montana, the **Malta Irrigation District** identified a need for a new headgate structure at the Dodson South Canal and for acoustic Doppler flow meters to improve operational control and efficiency in the system. The district is undertaking this work through a 2014 WaterSMART Grant. The district plans to leave water saved from the project in the Milk River to benefit upstream and downstream users as well as the endangered Pallid Sturgeon's critical habitat.

In addition to projects focused on improved water management, entities can identify opportunities to install renewable energy components. As part of a 2014 WaterSMART Grant, the **Davis and Weber Counties Canal Company** in northern Utah is replacing 1,000 feet of unlined, open canal with 66-inch reinforced concrete pipe, and replacing 3,430 feet of a deteriorating concrete lined, open canal with two 72-inch reinforced concrete pipes. As part of the project, the company will also install two 10-kilowatt hydroelectric units on the canal, which together are expected to generate 86,400 kilowatt hours of power per year. The project is ongoing and is expected to be completed in 2017.



Municipal entities also identify water management improvements to be undertaken through WaterSMART Grants. In California, the **City of Yucaipa** is using 2015 WaterSMART Grant funding to construct a 25 acre-foot retention basin along the Wildwood Creek to capture stormwater runoff and increase groundwater recharge. Recharged stormwater will recharge 250 acre-feet of water annually and will reduce the City's reliance on imported water supplies.

Other municipal entities have identified rebate programs as a tool for conserving water. Through a 2011 WaterSMART Grant, the **Edwards Aquifer Authority** near San Antonio, Texas, implemented a regional water conservation program providing economic incentives for a range of water efficiency improvements such as replacement of inefficient plumbing fixtures such as toilets and showerheads. The Authority also provided rebates for conversion of commercial/industrial equipment to more water efficient technologies and for equipment to implement graywater and rainwater collection. This program helped the Authority reduce the need for aquifer pumping by an estimated 692 acre-feet per year and energy consumption by approximately 790,000 kilowatt hours per year.

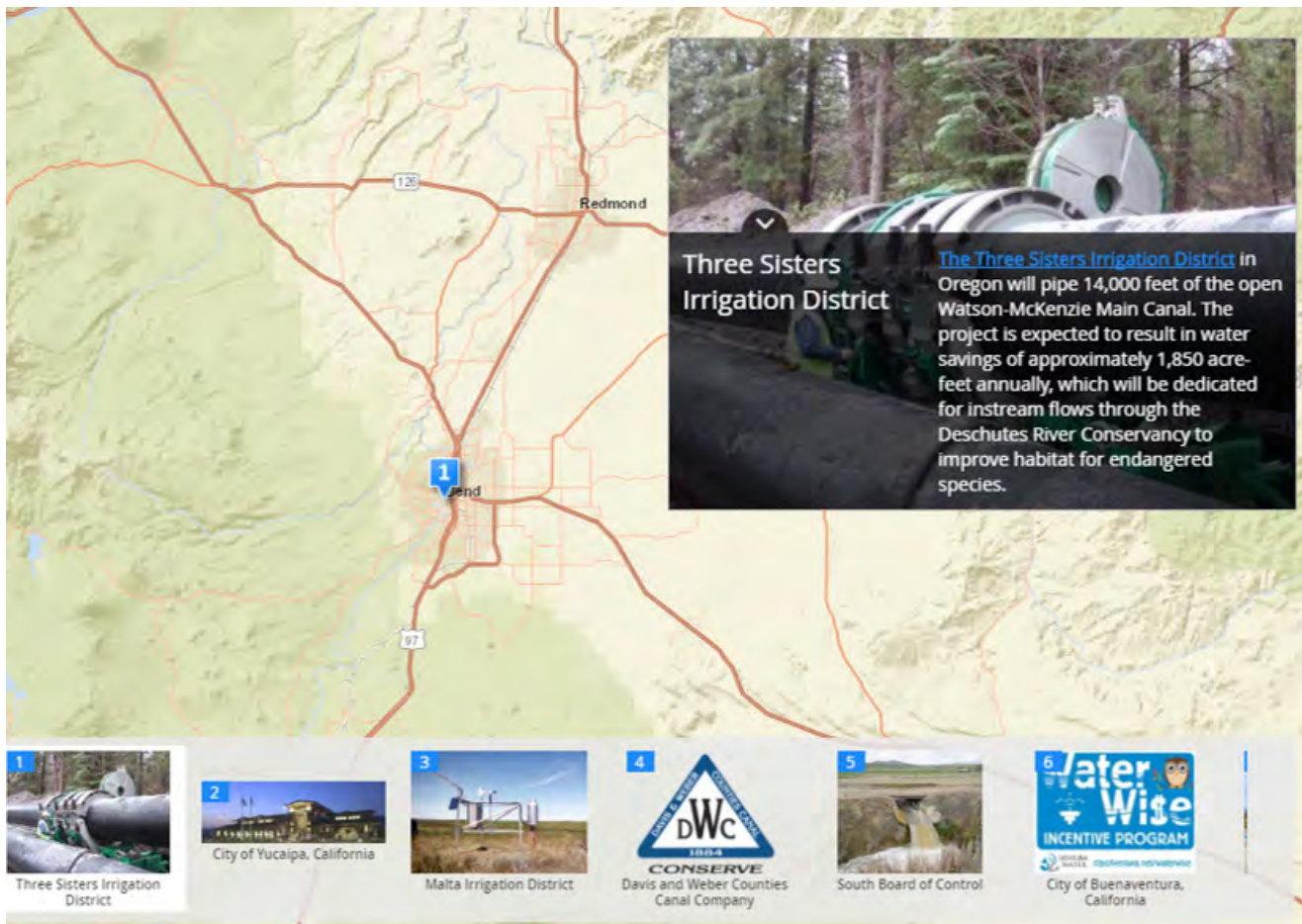
In Kansas, the **City of Topeka** is focused on metering as a way to better manage water supplies. Through a 2014 WaterSMART Grant, the City is replacing 500 commercial and residential water meters with advanced metering infrastructure; installing acoustic leak detection and pressure sensors to detect distribution leaks; and implementing a Meter Data Management System.



*The City of Topeka will replace 500 commercial and residential water meters in the City with advanced metering infrastructure.*

*Take a tour around the west to view featured Water and Energy Efficiency Grants in the WaterSMART Data Visualization online.*

<http://arcg.is/1TcT68S>





## Priority Goal for Water Conservation

*Interior enables capability to increase the available water supply for agricultural, municipal, industrial, and environmental uses in the Western U.S. through Reclamation's water conservation programs, which include the WaterSMART Title XVI Water Reclamation and Reuse Program and the WaterSMART Water and Energy Efficiency Grants.*

Beginning in 2010, Interior and other Federal agencies established a series of outcome-based, performance goals to help focus on key initiatives. One of the five goals identified as Interior's highest priorities was a new Priority Goal for Water Conservation. Since 2010, Interior has extended some of its goals, including the Priority Goal for Water Conservation. Interior and Reclamation are currently working to address that expanded Priority Goal: *To enable the capability to increase the available water supply through Reclamation's water conservation programs to 1,100,000 acre-feet by the end of September 2017.*

For more information on the Priority Goal for Water Conservation and other Reclamation goals, check out <https://www.performance.gov/>.

### Contributing Activities

Reclamation addresses the Priority Goal for Water Conservation through two significant WaterSMART activities: WaterSMART Grants and the Title XVI Water Reclamation and Reuse Program. Both of those programs result in projects that have quantifiable water savings. Several other regionally-focused water conservation efforts also result in quantifiable water savings that contribute toward the goal.

### Calculating Water Savings

Each year, Reclamation reports the water savings expected to result from water conservation activities funded that year. Water savings for each funded project are based on estimates of the number of acre-feet of water expected to be conserved each year after the project becomes operational. The estimates are provided by non-Federal project sponsors in applications for financial assistance, feasibility reports and other project planning reports, and National Environmental Policy Act documents. Estimates are based on water measurement and accounting records, calculations by the project sponsor's engineering sources, hydrologic modeling, statistical analysis of historical climatic data, and other information. Reclamation reviews project sponsors' estimates to ensure that each estimate is adequately supported and then works with project sponsors to make any necessary adjustments.



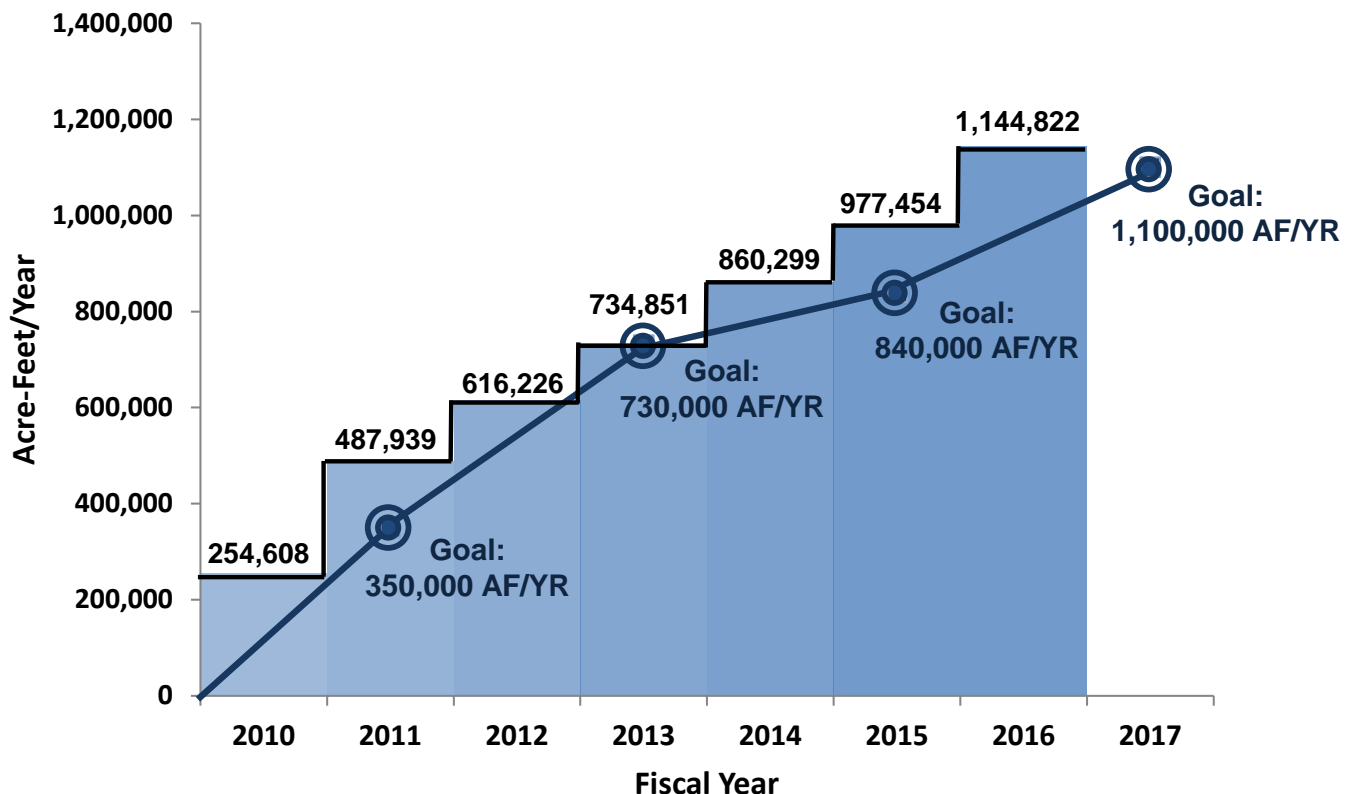
Each year, Reclamation reports the water savings expected to result from water conservation activities funded that year. Water savings for each funded project are based on estimates of the number of acre-feet of water expected to be conserved each year after the project becomes operational. The estimates are provided by non-Federal project sponsors in applications for financial assistance, feasibility reports and other project planning reports, and National Environmental Policy Act documents. Reclamation's technical experts conduct a review of project sponsors' estimates to ensure that each estimate is adequately supported and consistent with empirical results of similar projects and existing scientific information about water savings. Reclamation requests additional information if necessary, and then works with project sponsors to make adjustments.

*"Water and energy efficiency are intricately linked, when we conserve water, we also conserve the energy it takes to move it. One way we can achieve these efficiencies is to bring federal resources to the table for local projects that focus on saving water. This program represents one more way we're focusing resources on projects to provide resiliency in the face of drought."*

Commissioner López  
(WaterSMART Grants press release, 2016).

## Progress Toward the Priority Goal

Projects funded from 2010 to 2015 are expected to result in 1,144,822 acre-feet of water savings per year once completed. Based on water savings reported through 2016, Reclamation and Interior have now exceeded the goal of 1,040,000 acre-feet of water savings per year – about one and a half times the amount of water needed for household use in Denver, Colorado and the surrounding metropolitan area each year – by September 2017.







## Drought Planning and Resiliency

Severe and sustained droughts are part of life in the Western U.S., frequently resulting in water shortages, affecting agriculture, municipalities, and ecosystem functions. As an entity established at the turn of the 20th century to provide water in the Western U.S., Reclamation addresses drought as part of our mission.

While droughts in the West are common, there is growing evidence that climate change is exacerbating drought conditions. Temperature increases have resulted in decreased snowpack, and differences in the timing and volume of spring runoff for some basins. Precipitation changes have already occurred and are expected to continue interacting with warming to cause longer term and more frequent droughts.

Along with an increased understanding of potential climate impacts is an increased awareness of the need to plan ahead to build resiliency to drought. Governments and stakeholders at all levels are pursuing a more proactive approach that incorporates risk management with the end goal of increasing the sustainability of water supplies. The pitfalls of not preparing for drought are well-documented and include the high cost and relative ineffectiveness of emergency actions; the lack of data, tools and processes to understand and react to drought; and the increased severity of impacts following from the failure to build resilience.

Reclamation's Drought Response Program, initiated in 2015, supports a proactive approach to drought. Through the Drought Response Program, Reclamation provides assistance to water users to conduct drought contingency planning, including consideration of climate change information, and to take actions that will build long-term resiliency to drought. This program supports projects to avoid drought-related crises in the short term, while laying a foundation for climate resiliency in the long term.

*Through the Drought Response Program, Reclamation supports communities as they build resilience to drought and climate change in advance of a crisis.*

*"Drought is, and will be, a major challenge for water managers. We need to be nimble and adjust to those future realities."*

Commissioner López  
(Drought Response Program  
press release, 2016).



Lake Mead, August 2008. Photo by Alexander Stephens, Reclamation.

## Drought Contingency Plans

**Eligible Applicants:** States, Tribes, irrigation districts, water districts, and other organizations with water or power delivery authority in the Western U.S. or Hawaii.

**Federal Funding and Non-Federal Cost Share:** Federal funding up to \$200,000 to develop a drought contingency plan or to update an existing plan with a cost share of 50% or greater.

## Drought Resiliency Projects

**Eligible Applicants:** States, Tribes, irrigation districts, water districts, and other organizations with water or power delivery authority in the Western U.S. or U.S. Territories.

**Federal Funding and Non-Federal Cost Share:** Federal funding up to \$750,000 to implement projects that will build long-term resiliency to drought with a cost share of 50% or greater.

## Drought Response Program

Reclamation reformulated its existing drought program in 2015 to improve assistance to States, Tribes, local governments, and districts or other organizations with water or power delivery authority as they build resilience to drought. The Drought Response Program supports the goals of the President's 2016 Memorandum and Federal Action Plan on Building National Capabilities for Long-Term Drought Resilience. The Presidential Memorandum recognizes the importance of local leadership by states, counties, cities, non-profits and the agricultural community.

Funding for the Drought Response Program is allocated through a competitive process for the following activities:

**Drought Contingency Planning:** Reclamation provides financial assistance to develop or update drought contingency plans. Plans must include input and participation by a diverse set of stakeholders. Plans also consider climate change impacts to drought conditions and identify potential drought mitigation and response actions to build resilience to drought as exacerbated by climate change. Actions identified in the plans may be eligible for funding as "drought resiliency projects" so long as they meet program requirements.

Drought planning is an essential tool for communities and all levels of government to reduce the impacts from drought before a crisis occurs. As explained by the National Drought Mitigation Center, most drought contingency planning processes are structured to address the three following questions:

- How will we recognize the next drought in the early stages? Most drought plans include a monitoring plan to collect water availability data to identify the onset of drought and to assess its severity.
- How will drought affect us? A "vulnerability assessment" is conducted as part of the drought planning process to evaluate the risks to resources and sectors within the planning area and the factors driving those risks.
- How can we protect ourselves from the next drought? Once drought risks have been identified, planners can identify mitigation and response actions to address those impacts.



The planning process used in Reclamation's Drought Response Program is structured to help planners answer these three key questions and to encourage an open and inclusive approach.

**Drought Resiliency Projects:** Reclamation also provides financial assistance to implement projects that build long-term resiliency to drought. Proposed projects that are supported by an existing drought contingency plan will be prioritized for program funding. Projects that are eligible for funding include projects that:

- Increase the reliability of water supplies through infrastructure improvements
- Improve water management through decision support tools, modeling, and measurement
- Facilitate the sale, transfer or exchange of water
- Provide protection for fish, wildlife, and the environment

Even small investments in infrastructure can improve resiliency to drought conditions by increasing water management flexibility and providing alternative sources of water supply. For example, constructing new surface water intakes and new conveyance system components—such as pipes or pumping plants—can provide water managers with much needed options to deliver water from alternative sources, or support voluntary transfers of water during drought. Likewise, aquifer recharge facilities can support water banking in wet years for use in dry years. Investments in modeling and decision support tools provide critical information to allow water managers to act quickly to avoid a crisis.

### Emergency Response Actions:

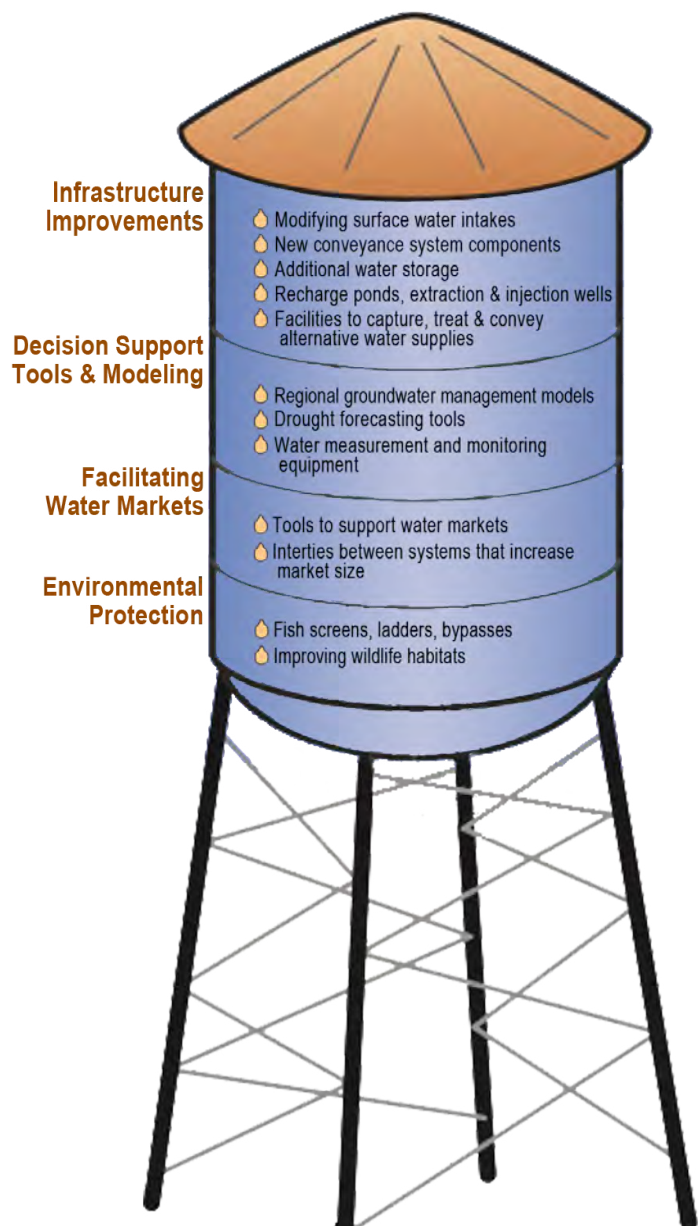
Reclamation will continue to fund emergency measures, such as temporary pipes or pumps, or hauling water to address ongoing drought emergencies as authorized under Title I of the Reclamation States Emergency Drought Relief Act of 1991 (Drought Act). To be eligible, a State governor or tribal leader must declare a drought and request assistance in writing for the proposed emergency response action, or have a drought plan on file with Congress. Emergency response actions are typically crisis-driven actions in response to unanticipated emergencies.

*“An unprecedented drought is gripping the Western U.S., and many communities are struggling to meet their basic need for water. Helping these communities address these water needs is important to ensure their welfare so they are able to meet their basic needs.”*

Commissioner López  
(Drought Response Program  
press release, 2016).

## Eligible Drought Projects

*Projects that build long-term resiliency to drought*





## Program Update

*WaterSMART Data Visualization Tool Map of the WaterSMART Drought Response Program from 2010 – 2016. Click on a project for more information.*

<http://arcg.is/1TcT68S>

Since the new Drought Response Program was established in 2015, the program has provided over \$10 million in competitively-awarded funding to non-Federal partners, including Tribes, water districts, and municipalities for drought planning and drought resiliency. In 2016, Reclamation selected 9 contingency plans and 14 resiliency projects to receive a total of almost \$5 million in WaterSMART Drought Response Program funding.





Lake Mead on the Colorado River.  
Photo by Reclamation.

### Did you know?

*In the Colorado River Basin, average inflow over the period 2000 - 2015 represents the lowest 16-year period in approximately 100 years of measured record, dating back to 1906. Paleorecords indicate that this period was also one of the lowest 16-year periods for natural flow in the past 1,200 years.*

*On April 22, 2014, the U.S. Drought Monitor's weekly report marked the first time in its history that the entire state of California was dealing with moderate to exceptional drought.*

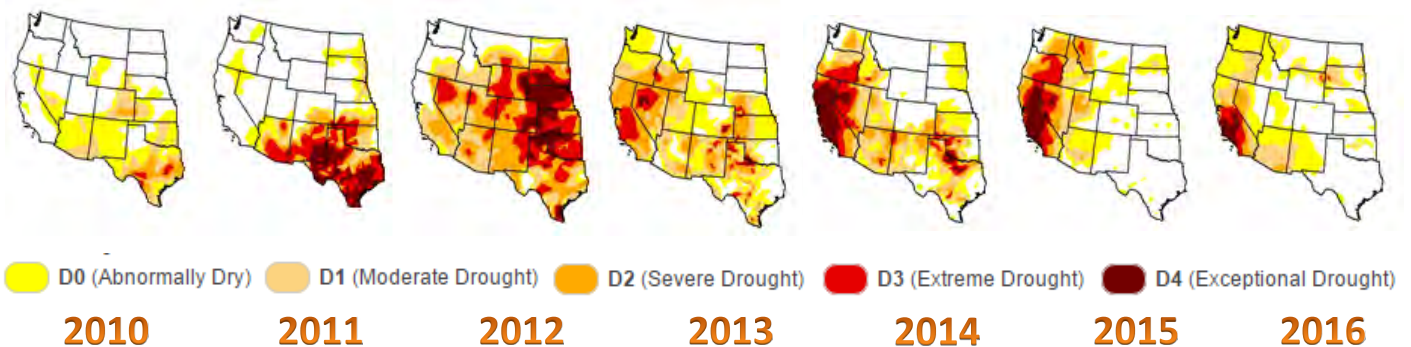
As shown on the WaterSMART Data Visualization Tool Map, in just these first two years of the Drought Response Program, Reclamation has funded a broad variety of projects, in terms of scale and size, located across 13 different states. These include large-scale drought contingency plans, such as the **Washington State Department of Ecology's** effort to update their 2005 statewide drought contingency plan, and efforts on a far smaller geographic scale, such as the proposed drought plan for the **City of Gallup, New Mexico** to create a regional drought contingency plan for a community of about 20,000 people, including numerous disadvantaged communities throughout McKinley County and the Zuni and Navajo Reservations.

Through WaterSMART, Reclamation is contributing to the Department's National Drought Resilience Partnership through the Missouri Headwaters Basin pilot in southwest Montana. Reclamation is providing Drought Response Program funding for a regional Headwaters Basin Drought Contingency Plan. The proposed drought plan will leverage information about climate change impacts made available through the ongoing WaterSMART Missouri River Basin Study and Impacts Assessment.

*Reclamation is taking action to address drought head on, including developing the basin-wide Pilot System Conservation Program in the Colorado River Basin, and developing a contingency plan in California to provide a roadmap for operation of key water projects during drought.*

## U.S. Drought Monitor

Moving drought conditions in the western U.S. from 2010 through 2016







*The Washington Department of Ecology also collaborated with Reclamation on the Yakima River Basin Study, which was completed in 2011.*



*McPhee Dam is located on the Dolores River a tributary of the Colorado River. Reclamation photo.*

## Featured Plans

By providing funding for drought contingency plans, Reclamation supports water management agencies in the Western U.S. as they plan and prepare for drought. From large, ambitious state-wide plans to plans focused on municipal areas or rural agricultural districts, the examples highlighted below represent the diverse needs addressed by the drought plans.

The **East Bay Municipal Utility District** and other regional water management agencies within the Bay Area in California will develop a drought contingency plan to improve water supply reliability during times of shortage. The plan will cover nine counties surrounding the San Francisco Bay.

The **Washington State Department of Ecology** will update its drought contingency plan, last published in 1992. The updated plan will strengthen the existing version by prioritizing specific drought response and mitigation actions, and incorporating lessons learned during the 2015 statewide drought emergency.

The **Dolores Water Conservancy District** in Colorado will develop a drought contingency plan with the Ute Mountain Ute Tribe Farm and Ranch Enterprise, and the Montezuma Valley Irrigation Company. The plan will include an evaluation of mitigation and response actions to improve drought resiliency for water users through collaboration with local agricultural districts, tribal farmers, municipal and industrial users, non-governmental organizations, and Federal and state agencies.

## Featured Projects

The following examples showcase the wide-ranging benefits that drought resiliency projects provide to communities during periods of drought. Whether by constructing infrastructure improvements to augment existing supplies, creating modeling tools that more accurately predict drought, or installing water quality monitoring devices that provide more accurate information, there are many ways in which these projects provide flexibility to water managers.

The **Waurika Lake Master Conservancy District** in southwestern Oklahoma will install an extension intake pipe to the lowest point in Waurika Lake and add a floating intake to access water at more points, including the lake's lowest elevations. The project will enable the district to access an additional 25,000 acre-feet during drought conditions.



The **Texas Water Development Board** will modify their existing drought prediction tool to provide more accurate forecasts of average May-July rainfall, reservoir levels, and reservoir storage for the State of Texas. By providing early warning of drought, early response measures may be taken to mitigate drought and to reduce the need for severe use restrictions. Forecasts will be updated on a bi-weekly basis and made accessible through the Water Data for Texas website at <http://waterdatafortexas.org/reservoirs/statewide>.

**Southern Nevada Water Authority**, a wholesale water provider, will install real-time water quality monitoring equipment that will enable faster evaluation of untreated water from Lake Mead. This project will equip the authority with better instrumentation--enabling quick responses to rapidly changing water quality while continuing to provide safe drinking water for nearly 2 million residents in Clark County, Nevada.

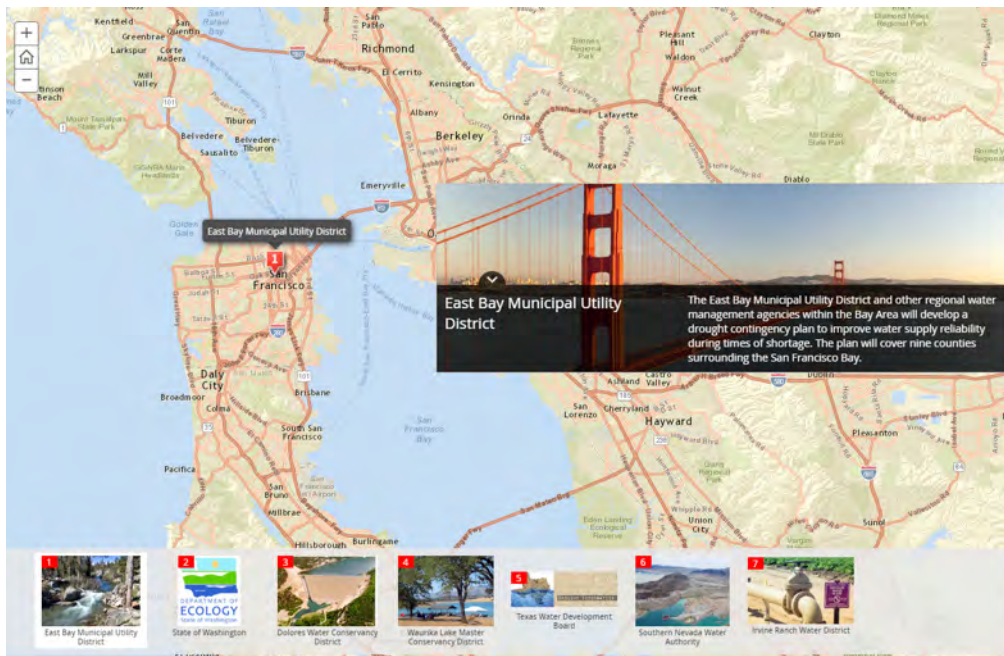
**Semitropic Water Storage District** in southern San Joaquin Valley, California will equip nine existing aquifer recovery wells with pumps, motors, discharge piping, and electrical equipment for completion of an Aquifer Storage and Recovery project. The project will enable more effective extraction of banked water supplies for participants of the Semitropic Storage Banking Program.



*Lake Mead from Hoover Dam in March 2014.*



*Photo courtesy of Semitropic Water Storage District, all rights reserved.*



*Take a tour around the west to view featured Drought Plans and Projects in the WaterSMART Data Visualization online*  
<http://arcg.is/1TcT68S>

Reclamation expects that providing support for drought contingency planning and projects to build drought resilience may also reduce the need for some emergency response actions. For more information on the WaterSMART Drought Response Program, see: <https://www.usbr.gov/drought>.





## Cooperative Watershed Conservation and Management

Watershed management is a complex task, particularly in the Western U.S., where there are many competing demands for water and water supplies are highly variable. To be effective, watershed management must incorporate a collaborative, multidisciplinary planning process that can balance the ecological, economic, and social needs of a watershed. Increasingly, multidisciplinary watershed groups are being formed to meet this challenge.

Watershed groups bring together a diverse group of stakeholders, some of which might otherwise be at odds, to provide a platform for collaborative, locally-led and community based water resource management. Stakeholders may initially unite around one issue that affects multiple stakeholder groups, for example flood control or wildfire mitigation. However, these groups typically evolve to have a more holistic approach: aiming to address multiple issues within the watershed and benefit a wide range of stakeholders.

*“The Cooperative Watershed Management Program has made an incredible difference to the watershed because the people that we got together to talk about impacts never would have been in the same room without this funding. Groups that have historically been adversarial in the watershed are now having personal conversations and building trust.”*

- Representative of Sierra Streams Institute concerning establishment of the Bear River Watershed Group.



*Little Truckee River in-between Stampede and Boca dams, California.  
Photo by Alexander Stephens, Reclamation.*



### **Development of Watershed Groups (Phase I)**

**Eligible Applicants:** States, Tribes, local and special districts (e.g., irrigation and water districts), local governmental entities, and non-profit organizations in the Western U.S. and capable of supporting the sustainable use of water resources within the watershed.

**Federal Funding:** Federal Funding: Federal funding up to \$50,000 may be awarded to an applicant per year, for a period of up to two years with no non-Federal cost-share required.

### **Implementation of Watershed Management Projects (Phase II)**

**Eligible Applicants:** Established watershed groups that represent a diverse group of stakeholders, have completed a watershed restoration plan, and are capable of promoting the sustainable use of water resources.

**Federal Funding:** Federal funding up to \$100,000 per project for projects up to two years in length. A non-Federal cost share of at least 50% is required.

## **Cooperative Watershed Management Program**

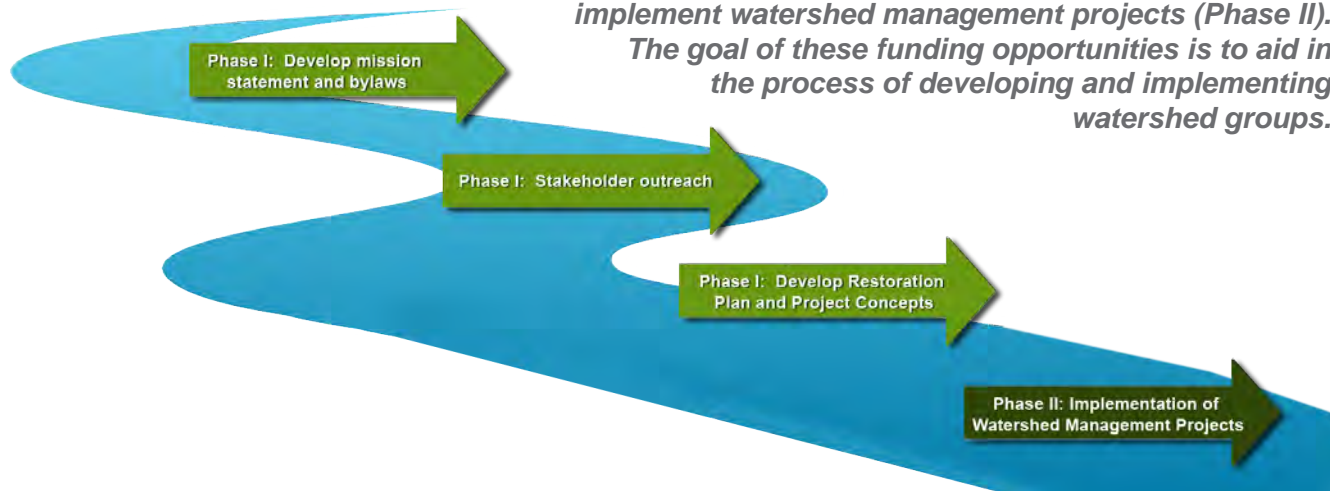
The Cooperative Watershed Management Program (CWMP) contributes to the WaterSMART strategy by providing funding to watershed groups to encourage diverse stakeholders to form local solutions to address their water management needs. By providing this funding, Reclamation is promoting the sustainable use of water resources and improving the ecological resilience of rivers and streams using collaborative conservation efforts. Funding is provided on a competitive basis for:

**Development of Watershed Groups:** In 2012, Reclamation began providing funding for the establishment or further development of watershed groups (Phase I). A watershed group is a self-sustaining, non-regulatory, consensus-based group that is composed of a diverse array of stakeholders, which may include, but is not limited to, private property owners, non-profit organizations, Federal, State, or local agencies, and Tribes. As part of Phase I activities, applicants may use funding to develop bylaws, a mission statement, watershed management project concepts, and a watershed restoration plan. For Phase I projects, Reclamation will award a successful applicant up to \$50,000 per year for a period of up to two years with no non-Federal cost-share required.

**Implementation of Watershed Management Projects:** Starting in 2017, Reclamation will provide cost-shared financial assistance to watershed groups to implement watershed management projects (Phase II). These on-the-ground projects, collaboratively developed by members of a watershed group, will address critical water supply needs, water quality, and ecological resilience, helping water users meet competing demands and avoid conflicts over water. Program

### **Cooperative Watershed Management Program Phases I & II**

*Reclamation offers two funding opportunities, one to establish or further develop a watershed group (Phase I), and another to implement watershed management projects (Phase II). The goal of these funding opportunities is to aid in the process of developing and implementing watershed groups.*



criteria will prioritize projects that contribute to the ecological resilience of the watershed. Reclamation will award up to \$100,000 per project over a two-year period. For Phase II projects, applicants must contribute at least 50% of the total project costs.

### Benefits of Local Watershed Management

The benefits of locally led watershed management efforts are numerous, interconnected, and dependent on the unique make-up and management strategy of each watershed group. However, many watershed management efforts are focused on increasing the resilience of the communities and ecosystems within the watersheds. Benefits from these management efforts generally fall into one of three categories:

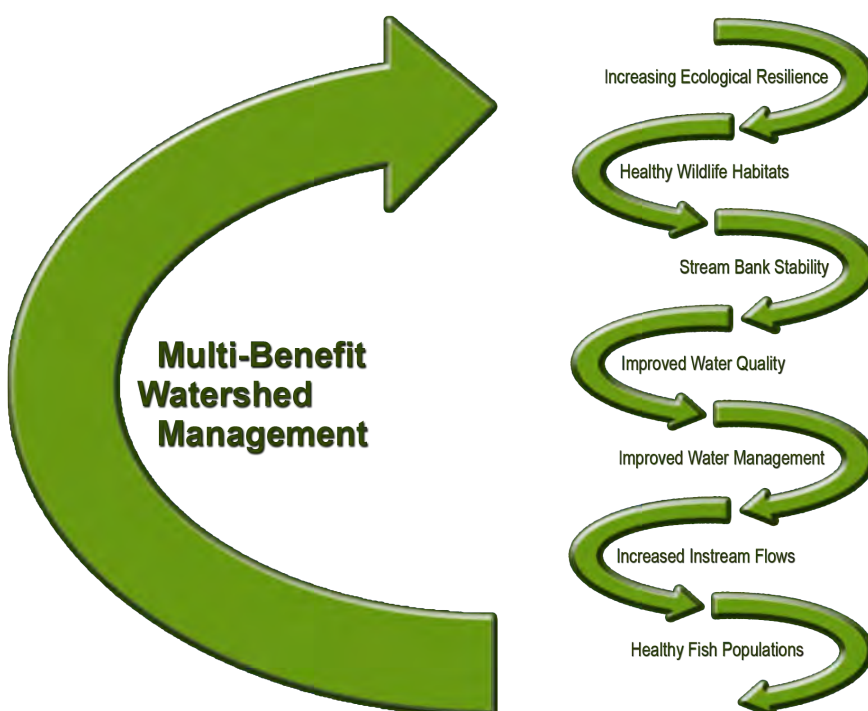
**1. Ecological Benefits:** Many watershed groups focus efforts on ecological restoration activities. Some groups focus on instream restoration activities that restore the river to a more natural flood regime and, in doing so, improving habitat for aquatic species. Other groups focus on restoring the riparian corridor to benefit wildlife habitat, stabilize stream banks, and restore natural rates of erosion.

**2. Water Quantity and Quality Benefits:** Some watershed groups focus on improving water quality or conserving water to increase instream flows. For example, groups mitigate wildfire contamination, decrease municipal and agricultural runoff by restoring wetlands and riparian vegetation, and reduce surface water diversions through small-scale water conservation projects and improved efficiencies.

**3. Social and Economic Benefits:** Groups often take a holistic approach to management and strive to provide social and economic benefits, such as improving soil health on agricultural lands, improving recreational opportunities, and reducing flood risk.

## Multiple Benefits of Watershed Management

*Watershed groups use a holistic approach to address issues that impact many water users.*

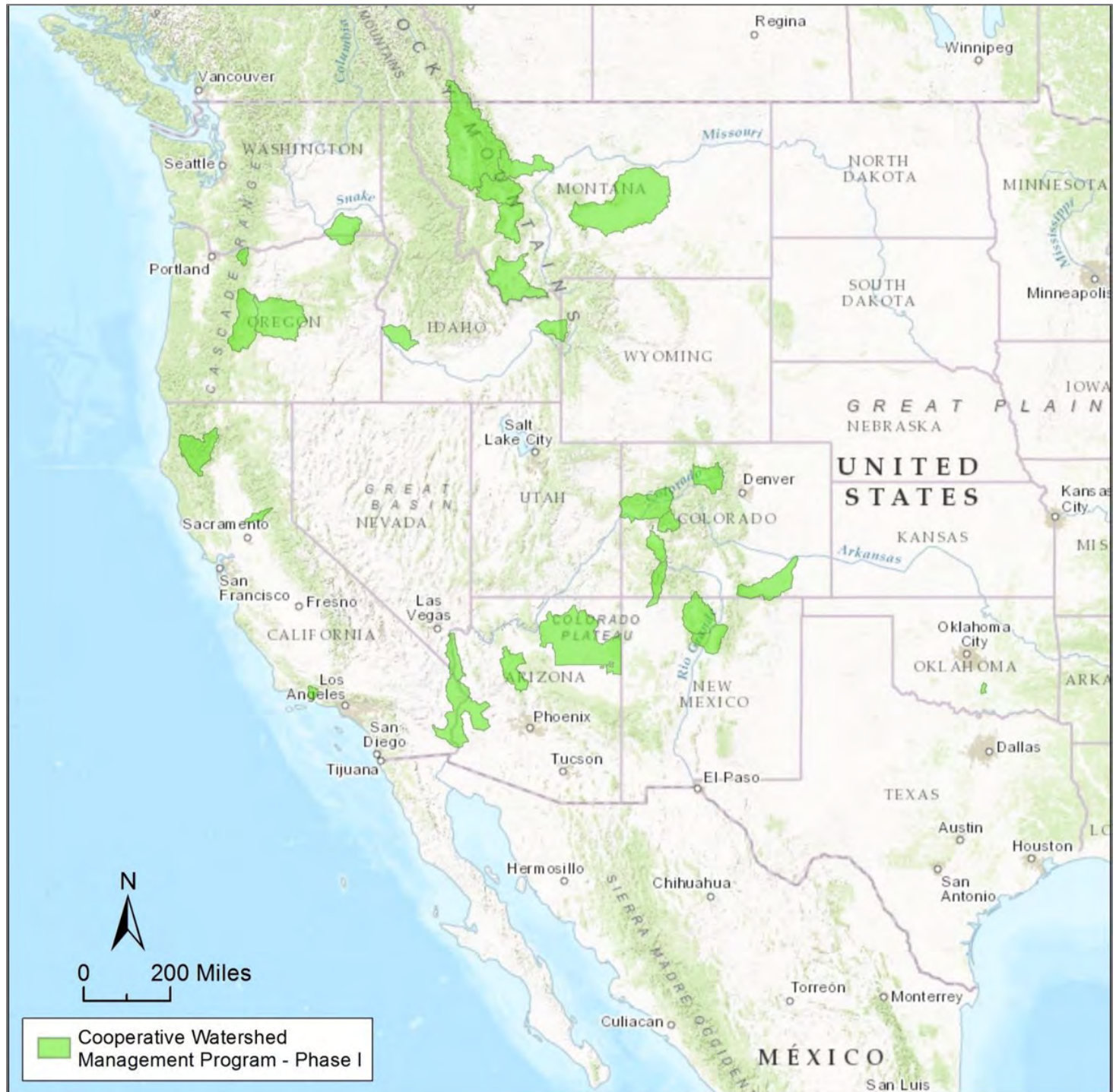


## Program Update

*WaterSMART Data Visualization Tool Map of the WaterSMART Cooperative Watershed Management Program from 2010 – 2016. Click on a project for more information.*

<http://arcg.is/1TcT68S>

Since 2012, Reclamation has awarded a total of \$2.4 million in funding for the establishment or further development of 30 watershed groups in nine states. This includes funding for 11 watershed groups recently announced by Reclamation in June of 2016. These groups are located in Arizona, California, Colorado, Idaho, Montana, New Mexico, Oklahoma, Oregon, and Washington.





In FY 2017, the President's budget requests \$1.75 million for this program, which is a substantial increase above the \$250,000 per year that has been appropriated for this program historically. Reclamation will use these funds to initiate Phase II of the CWMP, providing cost shared financial assistance for watershed management projects.

On average, applicants have requested \$2.3 million per year, which far exceeds the available program funding. We believe this is due to the fact that non-profit organizations are eligible to apply under the Cooperative Watershed Management Program, and due to the program's emphasis on building ecological resilience.

The Cooperative Watershed Management Program offers a unique opportunity for these watershed groups to get started, as explained by Tamsen Binggeli of the Boise River Enhancement Network:

*"The WaterSMART Grant provided critical seed money to establish our watershed group. The funding allowed us to adopt an organizational structure, develop governance procedures and elect a Coordinating Team representing diverse stakeholder groups. The Grant also provided funds to develop the Boise River Enhancement Plan – an informative, forward-looking plan to improve water quality, aquatic and riparian habitat and stream channel function through cooperative action."*

### *Did you know?*

**A watershed** is an area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel.

**Watershed management** is an adaptive, collaborative, multidisciplinary planning process that aims to balance the ecological, economic, and social needs of a watershed.

**A watershed group** is a self-sustaining, non-regulatory, consensus-based group that is composed of a diverse array of watershed stakeholders.

**Ecological resilience** is the capacity of a system to absorb disturbance and reorganize while undergoing change, so as to retain essentially the same function, structure, identity, and feedbacks.



*The Boise River near Boise, Idaho. See the featured projects section for more information on the watershed group that works in this Region. Photo courtesy of the Boise River Enhancement Network, all rights reserved.*



Members of the Bear River Watershed Group perform water quality monitoring along the Bear River below Chicago Park Powerhouse, California. Photo courtesy of the Bear River Watershed Group, all rights reserved.



Vegetation restoration project in Arizona. Photo courtesy of the Upper Verde River Watershed Protection Coalition, all rights reserved.

***“Although the Coalition continues to focus on water resource issues, during the planning process we found that the goals of many others are closely aligned with ours. For example, ranchers and land managers, the Game and Fish Department, State Forestry and Fire all agree that watershed health relates closely to grassland restoration, wildlife habitat, and reducing fire intensity.”***

- John Munderloh, Technical Advisory Committee Chair, Upper Verde River Watershed Protection Coalition.

## Featured Projects

The Sierra Streams Institute developed the **Bear River Watershed Group** in North-Central California. The watershed lies within four of the fastest growing counties in California - Nevada, Placer, Sutter, and Yuba Counties - which has increased the demand for water and exacerbated environmental concerns. The Bear River Watershed Group has provided an important forum for entities to discuss a proposal to build a new dam on the Bear River. Public meetings hosted by the watershed group have allowed entities with different opinions on the issue to come together and have discussions concerning the dam and concerning the management of other areas not impacted by the dam.

The **Upper Verde River Watershed Protection Coalition**, in Central Arizona, was successful in developing a watershed restoration plan that brought together multiple partners across resource areas and laid the foundation for watershed management projects. The coalition’s initial step was to form a watershed task force composed of stakeholders with responsibility and accountability for land or water resources in the watershed. This task force then developed a plan that contained broad-scale vision and specific on the ground watershed restoration projects. Buy-in from the stakeholders has made it possible for the coalition to implement various projects outlined in the watershed restoration plan, which has attracted additional partners, including private landowners, additional agencies, and the wood products industry.

The **Boise River Enhancement Network** is working with stakeholders on the Lower Boise River in Idaho to promote the ecological enhancement of the Boise River. Through the CWMP, the network developed the Boise River Enhancement Plan, focusing on stream channel function, fisheries and aquatic habitat, wetland and riparian habitat, and water quality issues. According to Tamsen Binggeli, a representative from the network, *“the Boise River Enhancement Plan is our primary enhancement tool--we use it to make recommendations and to prioritize projects. The Enhancement Plan has been widely supported by numerous agencies and stakeholder groups.”* This network was instrumental in getting approval for an instream habitat restoration project in the Boise River--the first such project in decades and a top recommendation in the Boise River Enhancement Plan.



The **Animas Watershed Partnership** in Durango, Colorado, developed a watershed plan to address concerns with the temperature, sedimentation, and E. coli levels in the Animas River. The Partnership stated that, *“with the support of Reclamation’s Cooperative Watershed Management grant, we have completed our bylaws, developed our vision, engaged an OSMRE Vista volunteer position (we are now in our third year), completed an assessment of the Florida River--the largest perennial tributary to the Animas River--engaged many new partner organizations and individuals, and completed two highly successful Soil Health Workshops, one in Durango and one in Farmington. We continue to look for ways to engage our communities in improving river health.”*

The Cooperative Watershed Management Program is supporting watershed groups to develop local solutions to water management issues through collaborative conservation efforts.

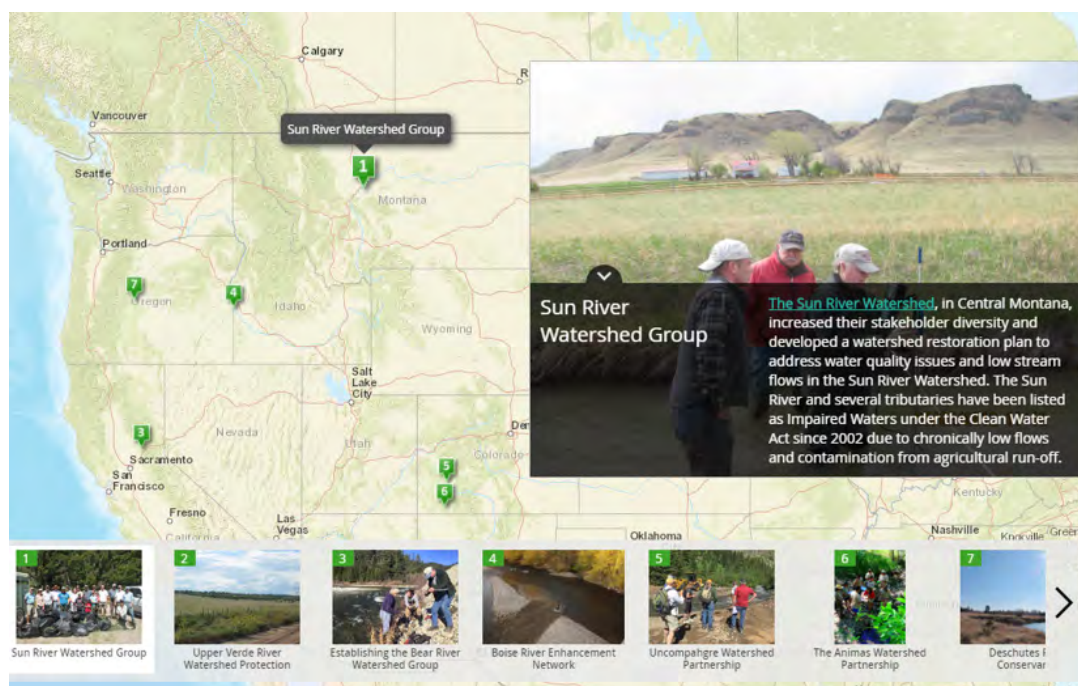
For more information on the WaterSMART CWMP, see:  
<https://www.usbr.gov/watersmart/cwmp>.



A fly fisherman on the Boise River, Idaho. Photo courtesy of the Boise River Enhancement Network, all rights reserved.



Volunteers plant willows in the Animas River watershed during an Animas Watershed Partnership event in Colorado. Photo courtesy of the Animas Watershed Partnership, all rights reserved.



Take a tour around the west to view featured Watershed Groups in the WaterSMART Data Visualization Tool Map online at  
<http://arcg.is/1TcT68S>





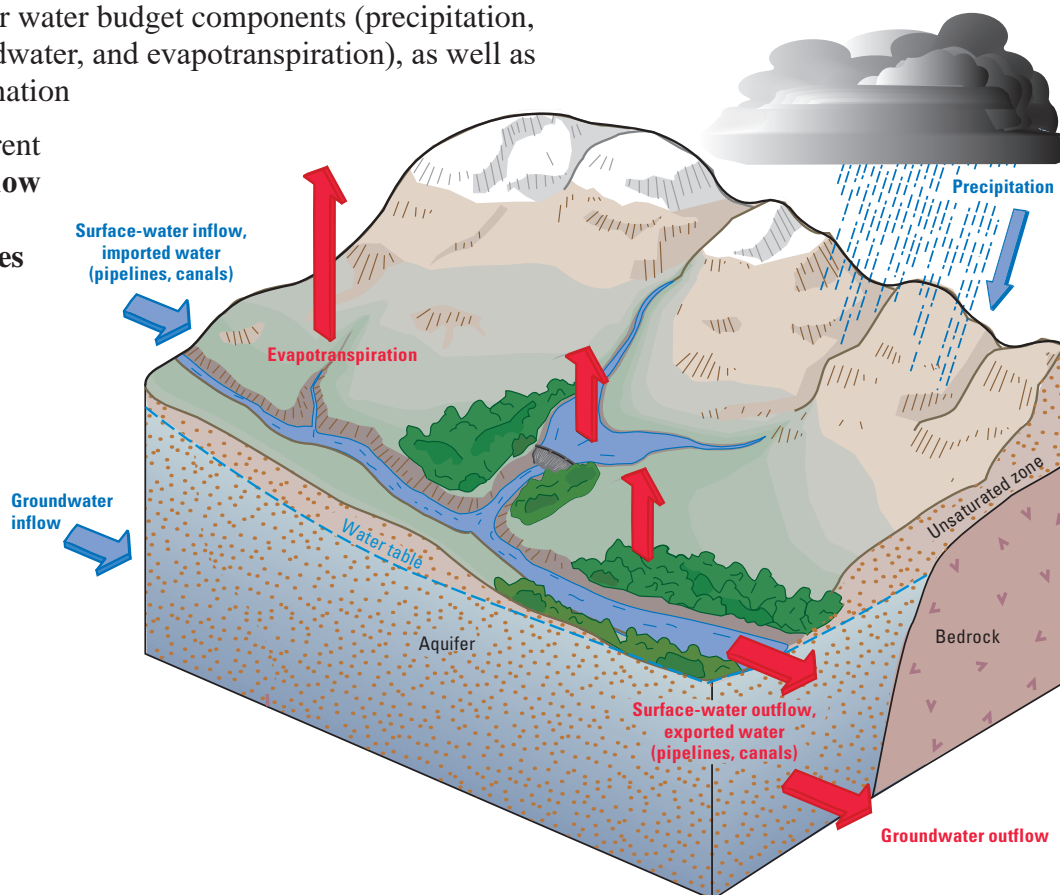
## USGS Water Availability and Use Science Program

While Reclamation's WaterSMART activities focus on water management in the 17 Western States, the USGS implements WaterSMART through a nationwide program of data collection, research, and information sharing. A key part of achieving Interior's sustainability goals is informing the public and decision makers about the status and changes over time of the Nation's water resources. To achieve these goals, through WaterSMART, the USGS has implemented a National Water Census (NWC) to provide a more accurate picture of the quantity of the Nation's water resources and improve forecasting of water availability for current and future economic benefits (e.g., public supply and irrigation), energy production, and environmental uses. In 2016, to streamline water sustainability activities, the USGS realigned all water availability and use oriented research, including the NWC, within a new Program: the Water Availability and Use Science Program (WAUSP).

*The concept of a National Water Census is consistent with the SECURE Water Act, which calls for the establishment of a "national water availability and use assessment program" within the USGS.*

WAUSP supports producing a current, comprehensive scientific assessment of factors that influence water availability by:

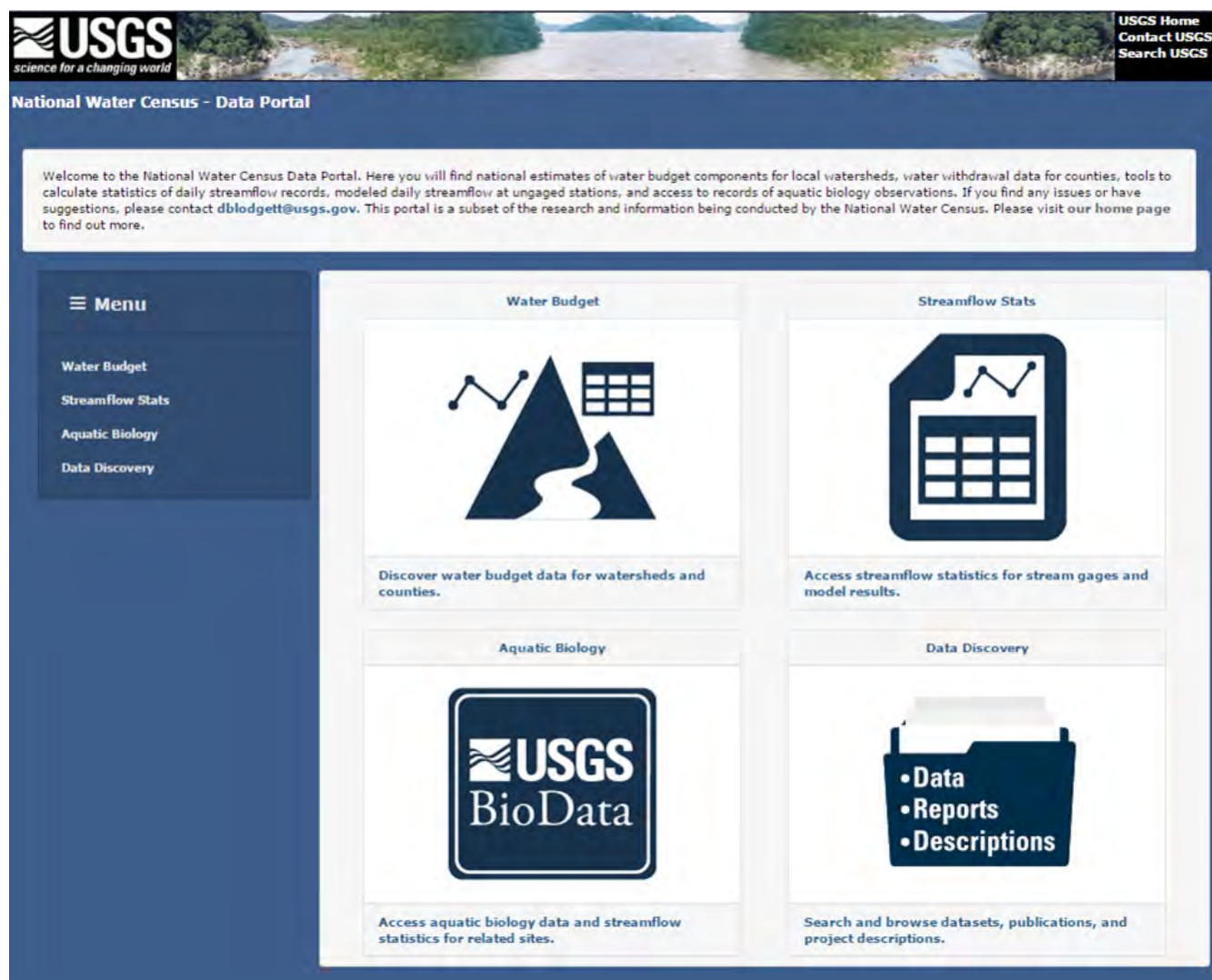
1. Developing **nationally consistent datasets** that reflect the status and trends of major water budget components (precipitation, streamflow, groundwater, and evapotranspiration), as well as water use, for the nation
2. Improving the current understanding of **flow requirements for ecological purposes**
3. Evaluating **water-resource conditions in selected river basins, or geographic Focus Area Studies**, where competition for water is elevated.



## Program Update

*To maximize the utility of the information, the USGS coordinates the design and development of the effort through the Federal Advisory Committee on Water Information.*

The SECURE Water Act authorized \$20 million for each of fiscal years 2009 through 2023 for the NWC. Considerable emphasis is placed on method and model development, Web-based tools for data delivery, and enhancement of water budget data. Much of the information developed as part of the NWC is derived from models, statistical estimation techniques, and other transformation processes. The NWC Data Portal (<http://cida.usgs.gov/nwc/>) allows users to access a comprehensive and nationally consistent interactive map interface to download data visualizations, retrieve stand-alone data for further analysis, or integrate multiple datasets with built-in and downloadable data-analysis tools. The following sections update USGS NWC projects since the first funding was received in 2011.



**USGS**  
science for a changing world

**National Water Census - Data Portal**

Welcome to the National Water Census Data Portal. Here you will find national estimates of water budget components for local watersheds, water withdrawal data for counties, tools to calculate statistics of daily streamflow records, modeled daily streamflow at ungaged stations, and access to records of aquatic biology observations. If you find any issues or have suggestions, please contact [dblodgett@usgs.gov](mailto:dblodgett@usgs.gov). This portal is a subset of the research and information being conducted by the National Water Census. Please visit our home page to find out more.

**Menu**

- Water Budget
- Streamflow Stats
- Aquatic Biology
- Data Discovery

**Water Budget**

Discover water budget data for watersheds and counties.

**Streamflow Stats**

Access streamflow statistics for stream gages and model results.

**Aquatic Biology**

Access aquatic biology data and streamflow statistics for related sites.

**Data Discovery**

Search and browse datasets, publications, and project descriptions.

• Data  
• Reports  
• Descriptions



## Geographic Focus Area Studies

Throughout the U.S., there are areas where competition for water resources has reached a level of national attention and concern. These competing interests may arise from multiple human needs (such as demands for potable water, irrigation, energy, industrial processes), from competition between human and aquatic ecosystem needs, or both. The USGS has initiated a series of stakeholder-driven studies, focused on selected large watersheds, where there is a desire on the part of watershed stakeholders to conduct a comprehensive technical assessment of water availability with the best available tools.

These geographic Focus Area Studies contribute toward ongoing assessments of water availability in these watersheds and also provide opportunities to test and improve approaches to conducting water availability assessment. The following sections outline the 3 initial studies, now completed, and the expected work of 3 new studies that began in 2016.

Conflict over water resources in the **Apalachicola-Chattahoochee-Flint River Basin** among Alabama, Florida, and Georgia has resulted from increases in water use for municipal and industrial supplies, power generation, and agriculture. Competition over water is not limited to the State borders. During drought conditions, competition among all water users can become pronounced. The study is addressing the complex interaction of withdrawals and discharges from groundwater and surface water on streamflow within the basin, and the potential impact on aquatic ecosystems.

The Colorado River is a critical source of water supply for much of the Southwestern United States. While surface water in the **Colorado River Basin** is carefully regulated and monitored, other components of the water budget are less well understood. Through stakeholder consultation, the USGS identified the following major components of the basin water budget for investigation:

1. Estimating current water use and historical (1985 - 2010) trends in water use,
2. Assessing evapotranspiration and the dynamic variation in snowpack water content for regional and field-scales
3. Estimating groundwater discharge to streams and rivers.

Better quantification of these components of the basin water budget provide water managers with the increased knowledge of water sources and water movement, and enhance their ability to make resource management decisions.

*In 2011 USGS began 3 focus area studies in the Apalachicola-Chattahoochee-Flint, Colorado, and Delaware River Basins that were completed in 2015.*

*In 2016, 3 new focus area studies began, in the Coastal Carolina, Red River, and Upper Rio Grande River Basins.*



*The study identified that 20 to 60 percent of the flow in the Colorado originates as groundwater discharge. Reclamation photo.*



*Upper Rio Grande Basin,  
New Mexico.  
Reclamation photo.*



*North Fork Red River, Oklahoma.  
Photo by Kevin Smith, USGS.*

*USGS Focus Area Studies are often performed in conjunction with Reclamation Basin Studies to build on the collaborative planning efforts in the area, such as in the Upper Rio Grande and Red River Basins.*

The **Delaware River Basin** covers parts of four States (New York, New Jersey, Pennsylvania, and Delaware). The basin has the largest inter-basin withdrawal of water east of the Mississippi River and provides water<sup>[1][2]</sup> to over 15 million people. The information, databases, and products developed as a part of the study will contribute significantly to the information needs of the Delaware River Basin Commission “Strategy for a sustainable future water supply.”

The **Upper Rio Grande Basin** of Colorado, New Mexico, Texas, and northern Mexico focus area study began work in 2016. The conjunctive use of water in the basin takes place under a myriad of legal constraints including the Rio Grande Compact agreement between the States, an international treaty with Mexico, and several Federal water projects. Changes in climate have reduced reservoir water supplies, leading to increased use of groundwater for irrigation, municipal and industrial uses, and for downstream delivery under the Compact. The study team will collaborate with Reclamation, USACE, USFWS, and other resource management agencies in the study area to better understand and adapt to these changes.

The **Red River Basin**, which is characterized by mostly flat agricultural land and is relatively arid, is at the center of a Federal lawsuit between the States of Oklahoma, Arkansas, Louisiana, and Texas, regarding the interstate transfer and sale of water in the basin. Beginning in 2016, the study has been collaborating with Reclamation, USACE, the USFWS, state water-management, environmental, and wildlife-management agencies, Tribes with jurisdictional areas in the basin, and other stakeholders to comprehensively assess water budgets and water availability under current hydrologic, climatic, land-use, and water-demand conditions; potential climatic scenarios; and possible land-use changes.

The **Carolina Coastal Basins** are in an area with ongoing and projected increases in permanent and tourist populations, extreme natural events (such as droughts, hurricanes, earthquakes), and issues related to sea-level rise that will place additional stress on societal and ecological systems currently competing for water resources. Beginning in 2016, the study has been collaborating with municipalities, water-suppliers, State regulatory and resource management agencies, universities, wildlife refuges, non-profit, and environmental stewardship groups of the coastal Carolinas to evaluate the impacts of these stresses particularly related to groundwater-surface water interaction, saltwater intrusion, and the associated impacts to ecosystem management.

## Topical Area Studies

As part of the NWC, the USGS also conducts studies to improve national estimates of individual water budget components, focusing on streamflow, groundwater, evapotranspiration, and water use to develop and improve the data needed to achieve a comprehensive and up-to-date assessment of water availability at both national and basin scales. An additional topical area study advances the science of ecological flow by quantitatively examining the relationships between water availability and healthy ecosystems.

Each topical area study seeks to enhance available data and associated information by developing new methodologies, improving data accessibility, and quantifying and reducing data uncertainty. In addition to providing a basis for national indicators of water flow and storage for the NWC, these studies support analyses of water availability by local and regional agencies and contribute to research quantifying national and global water cycles.

## Surface Water

The USGS network of streamgages provides both real-time information to meet operational needs of water managers and historical context for water resources planning and assessment. While extensive, the streamgage network cannot provide direct observations of streamflow at every location of interest. The NWC aims to improve upon the information that is currently available at ungaged locations by providing estimates of daily streamflow at Hydrologic Unit Codes (HUC)-12 watersheds nationally.

The NWC has completed preliminary studies comparing methods for estimating streamflow time series across the nation. Examples of the estimated time series are available via the NWC Data Portal for a pilot area in the Southeastern United States. Research on methods for expressing the uncertainty of these estimates is ongoing and will allow the addition of confidence intervals for daily streamflow estimates. In the coming years, estimated time series will be provided for the entire country.

### *Did you know?*

*The USGS operates more than 8,000 streamgages to provide information on floods, droughts, and current water availability across the United States.*

*Reported water use relies heavily on estimates by State agencies and estimation procedures vary from state to state.*

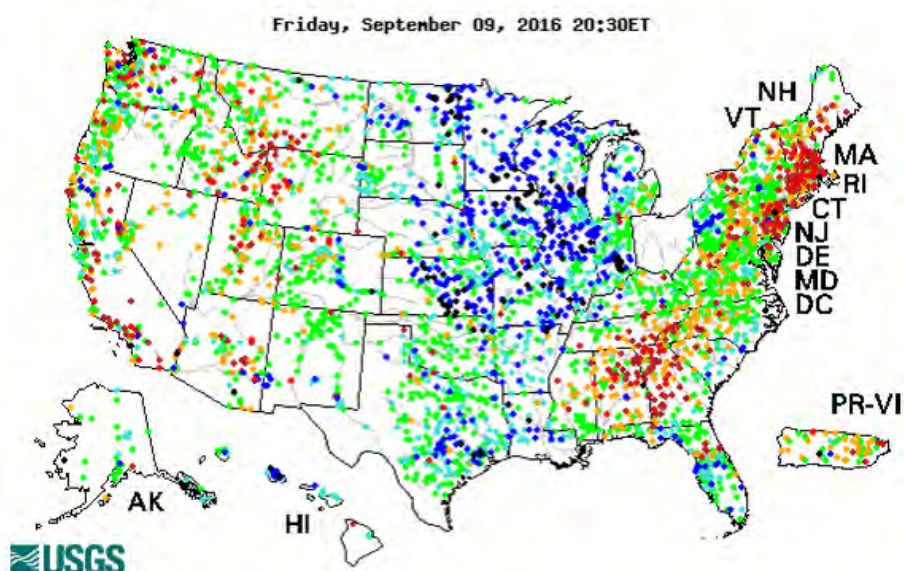
*The NWC provides an opportunity to establish agreed-upon standards for estimating, reporting, and storing water use data from various categories.*

*The NWC focuses efforts on the most critical areas rather than spread its effort equally over the landscape. One factor to consider in focusing efforts is where the uncertainty in different types of data is greatest.*

*HUC 12 is a more local sub-watershed level that captures tributary systems.*

*Map of real-time streamflow compared to historical streamflow for the day of the year (United States). Red values are below normal and blue are above normal.*

<http://waterwatch.usgs.gov>





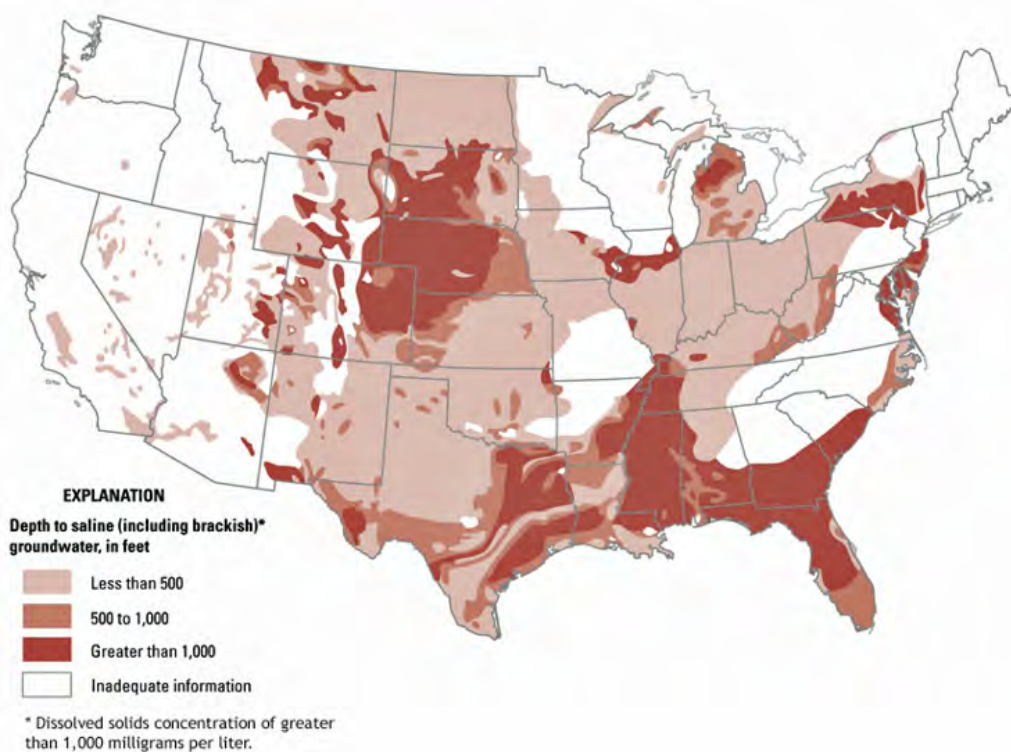
## Groundwater

*The National Brackish Groundwater Assessment is expected to be released in 2017. The publication will include a series of maps to identify the occurrence of brackish groundwater resources. States and water users will be able to use this information to explore the use of brackish groundwater in their area.*

Groundwater presents a particular challenge in providing a complete budget on a watershed basis. Aquifer systems are complex, three-dimensional geologic features. They can cover great distances, commonly do not conform to surface-water divides, and may obtain most of their recharge at locations far from where the groundwater discharges to a well or surface-water body. Because of these and other complexities, groundwater systems are incorporated into the NWC in two ways:

- Regional analyses of groundwater availability in principal aquifers that collectively account for more than 90% of the nation's total groundwater withdrawals.
- Estimates of groundwater recharge, storage, and discharge at the watershed scale to the extent possible. These estimates use a combination of information from regional-scale studies, data from observation well networks, analysis of streamflow records, and other available information.

The amount of fresh or potable groundwater in storage has declined for many areas in the U.S. and has led to concerns about the future availability of water for human and environmental needs. Use of brackish groundwater could supplement or, in some places, replace the use of freshwater sources. However, a better understanding of the location and character of brackish groundwater is needed to expand development of the resource and provide a scientific basis for making policy decisions.



*Depth to groundwater with total dissolved-solids concentration greater than 1,000 milligrams per liter in the United States. Map by USGS modified from Feth and others, 1965.*

To address this need the USGS is conducting a **National Brackish Groundwater Assessment** that uses a consistent national approach to:

- Compile existing information that can be used to characterize brackish aquifers
- Describe dissolved-solids concentrations, other chemical characteristics, horizontal and vertical extents of aquifers containing brackish groundwater, the ability of the aquifers to yield water, and current brackish groundwater use; generates national maps of dissolved-solids concentrations, to the extent that existing data allow
- Identify data gaps that limit full characterization of brackish aquifer.

The glacial aquifer system is present in parts of 25 states and contains the glacial sand and gravel principal aquifer, which is the largest water source for public supply and self-supplied industrial for any principal aquifer; it also is an important source for irrigation supply. The **glacial aquifer system groundwater availability study** is one of the USGS efforts in response to the WaterSMART initiative. This study is designed to provide information and analysis to stakeholders and decision makers for characterizing groundwater availability in regions within the glacial aquifer system. This study complements other USGS WAUSP regional aquifer studies designed to develop a national assessment of groundwater availability in USGS Principal Aquifers as part of the NWC.

In addition to work done as part of the NWC, and funded through WaterSMART, the USGS WAUSP is undertaking a series of **regional groundwater availability studies** in the Western U.S. to improve our understanding of groundwater availability in major aquifers across the nation.

## Evapotranspiration

Evapotranspiration is an essential component of water budget determinations for water availability. It is also a fundamental variable<sup>[1]</sup> of water use, especially for irrigation, with great importance for administration of water rights and river basin compacts. Historically, reliable quantification has required observations at sites with specialized instruments. However, these sites represent only local conditions, making evapotranspiration difficult to quantify over broad areas such as irrigation districts, river basins, or states. In addition to its application in water use and availability studies, remote sensing ET can be used to characterize and map the severity and extent of drought as it measures the response of the landscape to soil moisture distribution in space and time. Future work will produce historical evapotranspiration estimates going back to the 1980's at a field scale using improved computational platforms that allow the processing of large volumes of data.

*Extent of the Glacial Aquifer System Map by the USGS.*



*More information on the USGS Regional Groundwater Availability Studies please visit:*

<http://water.usgs.gov/ogw/gwrp/activities/gw-avail-a.html>

*The USGS is applying its satellite remote sensing resources and expertise to quantify evapotranspiration nationally and working to improve these estimates by collaborating with FASs in the west and east to improve the methodology and a finer scale.*

## Water Use

Information on human water withdrawals and return flows is critical to understand the demand part of the water budget. Better information about components of water use, such as withdrawal, conveyance, consumptive use, and return flow by sector of use, and the factors which influence these components, will allow water managers and users to make better decisions for the future.

*USGS continues to work with other organizations, Federal and non-Federal agencies, and universities to ensure that the information produced can be aggregated with other types of water-availability and socioeconomic information.*

Every five years since 1950, the USGS has produced a report, the *Estimated Use of Water in the United States*. The most comprehensive of these reports was for 1995, which provided total annual estimates of withdrawals by sector of use, public-supply deliveries to selected sectors of use, wastewater returns, and hydroelectric (instream) use, and consumptive use for selected sectors of use.

Efforts are underway to develop a national site-specific water-use database as part of the USGS National Water Information System, which will contain withdrawal, conveyance, use, and discharge return information for public supply system across the United States. Detailed, long-term information on withdrawals, conveyances, consumptive use, and return flows will provide the critical demand component for studies of the interactions between human water use and the natural hydrologic system. Additional efforts related to improving water use data nationally include reporting consumptive use estimates for selected categories, reporting water use by aquifer, and developing models to estimate thermoelectric water use.

## Ecological Water Science

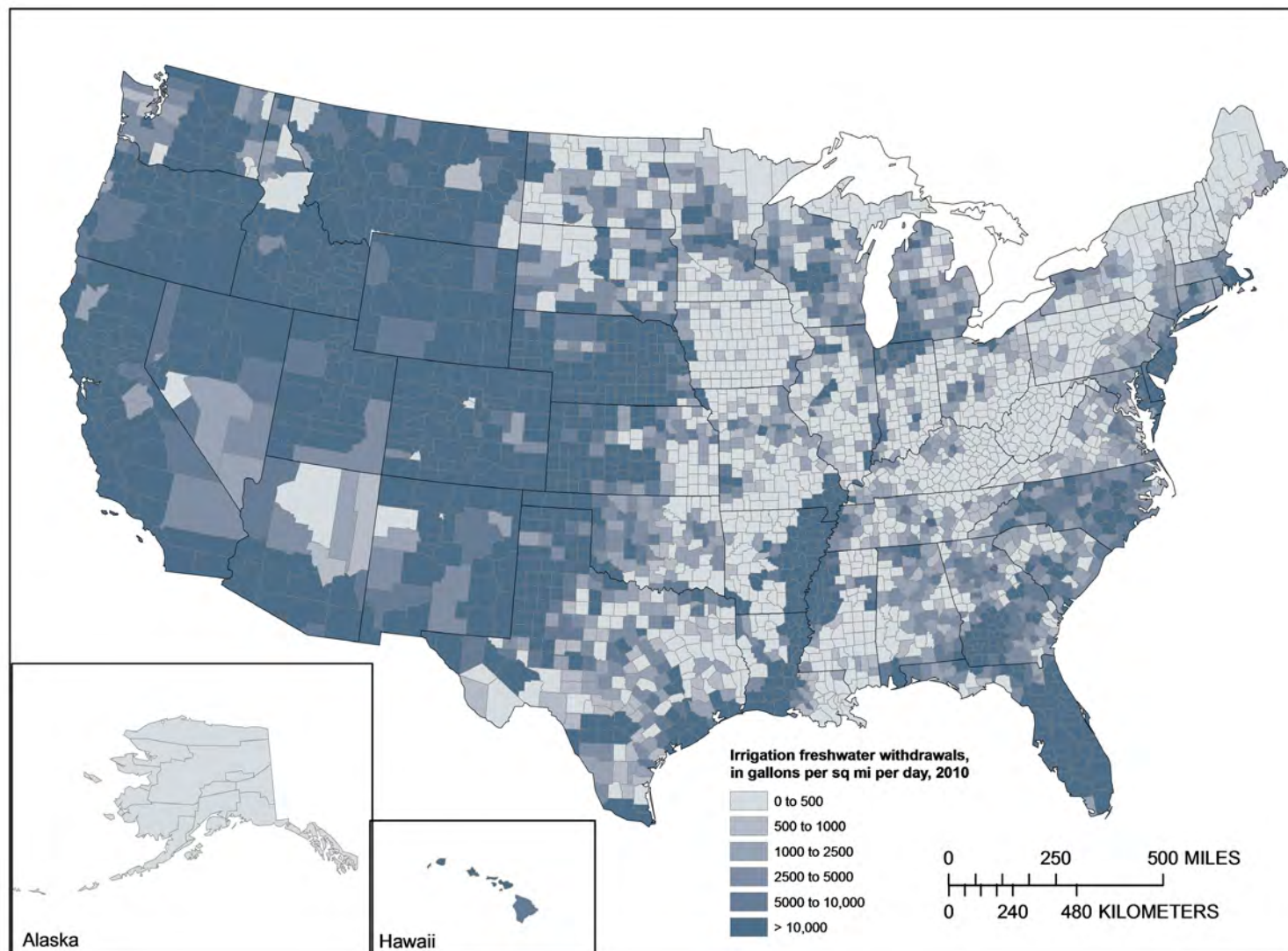
Ecological water science has advanced greatly over the past two decades, driven largely by a need to better understand how anthropogenic changes in water availability affect the streamflows required to maintain healthy freshwater ecosystems, and to advance the management of these ecosystems by maintaining a balance between human and ecological water needs.

The NWC has an important role to fulfill in ecological water science, and this includes developing novel tools and web-available resources that provide stakeholders and ecological water science practitioners with the hydrologic and biological information necessary for comparing natural and altered hydrologic regimes and understanding the effects of streamflow alteration on aquatic ecosystems.



*USGS, in cooperation with the Teton Conservation District, Wyoming, analyzed groundwater flow and streamflow, and collected water, aquatic insect, and algal samples to characterize the stream and to compare data to neighboring rivers and streams.*





## Planning for the Future

The USGS continues to work with other organizations, Federal and non-Federal agencies, and universities to ensure that the information produced can be aggregated with other types of water-availability and socioeconomic information. USGS and USBR closely coordinate on the science goals of relevant Focus Area Studies, the Brackish water assessment, and the Water Use Data and Research program to ensure that products meet the needs of stakeholders and water managers in making water resource management decision in the West. Future research goals include:

1. Evaluating the relations between water supply and quality for both human and ecological uses, including the potential use of impaired water supplies.
2. Developing geographic Focus Area Studies in additional basins.
3. Continuing to improve uncertainty analyses.

*USGS National Water Use information on freshwater irrigation withdrawals by county, 2010.*

*For more information on the USGS WaterSMART Program see:*

<http://water.usgs.gov/watercensus/WaterSMART.html>.



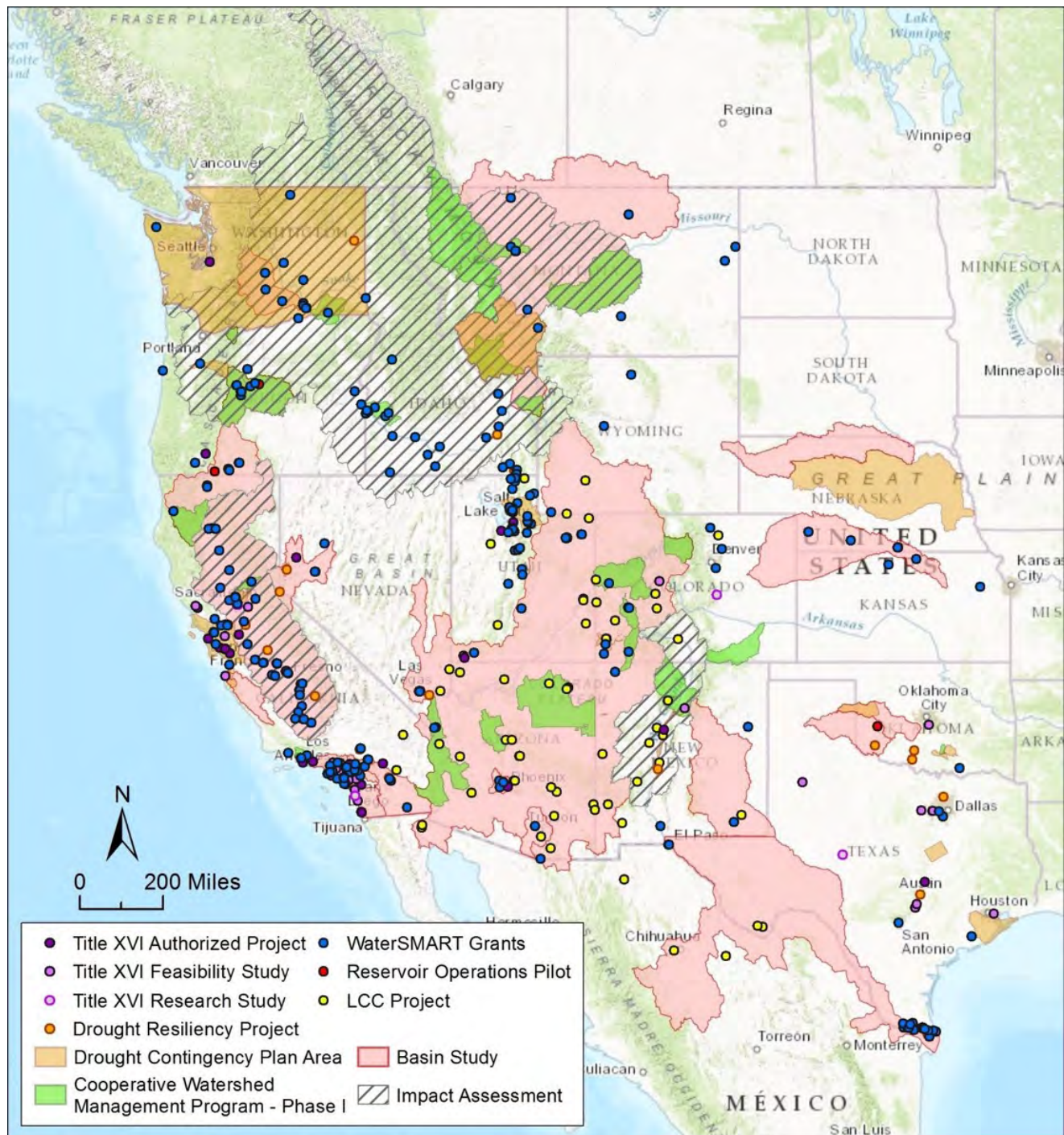


# Securing a Sustainable Water Future

Over the last seven years, the WaterSMART Program has enabled Interior and its partners to act in response to near-term and immediate water shortages and to plan for longer-term needs. Since 2010, Reclamation has provided approximately \$430 million in funding through WaterSMART, matched by funding from partners to carry out more than 550 water resources planning studies and on-the ground improvement projects in the Western U.S. WaterSMART data and scientific assessments have helped water users understand trends and make informed decisions about long-term water management strategies.

*WaterSMART Data Visualization Tool Map of Reclamation's WaterSMART Program activities from 2010 – 2016. Programs are represented by different shades and colors, and progress can be displayed over time. Click on a project for more information.*

<http://arcg.is/1TcT68S>





## Addressing the Resilience of Reclamation's Facilities

Reclamation's water resource infrastructure assets have a current estimated total replacement value of \$99 billion. From dams and irrigation facilities to hydropower generation and distribution, Reclamation's assets are a vital part of the Nation's economy, safety, and security. To ensure that Reclamation's infrastructure is sufficient to accommodate climate variability, WaterSMART now includes the **Resilient Infrastructure Program**. Through the program Reclamation is taking steps to address the challenges of incorporating climate change information into decisions about infrastructure *repair, replacement, and renovation investments* and protect infrastructure by supporting healthy and resilient watersheds. Reclamation is developing an enhanced decision making framework for prioritizing these types of infrastructure investments, including an approach to determine when climate change information should be incorporated into the design process. The decision framework and design criteria will be tested through a pilot process, using infrastructure investments that have the greatest potential to be influenced by climate impacts. The results of this effort will be used in Reclamation's infrastructure investment decisions.

The Resilient Infrastructure Program includes the **Western Watershed Enhancement Program**, which is a part of President Obama's Climate Action Plan, outlining a comprehensive approach to prepare the nation for the impacts of climate change, including increased risk of wildfires and drought. In May 2016, Interior announced \$500,000 in Western Watershed Enhancement Partnership funding to five projects to improve watershed health, reduce wildfire risk and post-wildfire erosion and sedimentation through rehabilitation of fire-damaged areas; restore wildlife habitat; and investigate watershed enhancement methods. Projects included: Boise River Pilot Project (Idaho), Cragin Watershed Protection Project (Arizona), Hemlock Project (California), Glacier Creek to Mill Creek Fuel Reduction Project (Colorado), and the Yakima Watershed Enhancement Project (Washington).

Reclamation is also working to improve drought preparedness by developing new processes that can be incorporated into reservoir management. In January 2016, Reclamation implemented five pilot activities to explore the tracking of water supplies affected by climate change, and to identify other reservoir operations opportunities, as part of the **Reservoir Operations Pilot Initiative**. Incorporated into the WaterSMART Basin Study Program WWCRA activity, the five reservoir operations pilot studies include the following locations:

- Great Plains Region: Upper Washita, Fort Cobb and Foss Reservoirs
- Mid-Pacific Region: Klamath River Basin, Klamath Project
- Pacific Northwest Region: Ochoco Creek and Crooked River
- Upper Colorado Region: Upper Colorado River Drought Contingency Plan, Climate and Operations Assessment Methodology
- Lower Colorado Region: Salt River Project, Salt and Verde Rivers

The Reservoir Operations Pilot Initiative is a key aspect of the National Drought Resilience Partnership Action Plan and a high priority action under Reclamation's Climate Change Adaptation Strategy first goal to increase water management flexibility. Reclamation is collaborating with USACE and the National Oceanic and Atmospheric Administration (NOAA) to evaluate how weather, hydrology, and climate change information could better inform operations. This effort will be used to develop Reclamation guidance on improving reservoir operations.

Between the partner-led WaterSMART projects and the investments in Reclamation operations and infrastructure, we are helping to build secure water supplies for communities in the Western United States. For example, in the seven-state Colorado River Basin, Reclamation and agencies representing the Basin States completed the seminal Colorado River Basin Study in 2012. In the Colorado River Basin and adjacent areas that receive Colorado River Water, Reclamation and its partners are carrying out over 70 WaterSMART Grant projects to address water efficiency—projects expected to result in over 85,000 acre-feet of water savings each year once completed—and 20 water reclamation and reuse projects that are now delivering about 314,000 acre-feet of recycled water each year. Along with development of two drought contingency plans, implementation of two drought resiliency projects, and development of nine local watershed partnerships through the Cooperative Watershed Management Program, these investments have made an important contribution to water operations during the current drought of record. Similarly, in basins across the 17 Western States—places as diverse as the Sacramento-San Joaquin, the Los Angeles Basin, the Yakima Basin, the Upper Missouri Headwaters, the Republican, and the Upper Red River—investments are paying off for local water users and communities. The WaterSMART program represents a comprehensive, science-based and partner-led approach to solving water challenges in the 21st Century.



*The Klamath River Basin Pilot Study is focused on improving supply and demand forecasting. Photo by Reclamation.*

*For more information on the Reservoir Operations Pilot Initiative visit the website here:*

<https://www.usbr.gov/watersmart/wcra/reservoirpilot.html>

## Strengthening WaterSMART

Reclamation continues to make adjustments to WaterSMART, based on stakeholder feedback and regular review of results, to ensure that available funding helps water managers address priority issues effectively. Reclamation has made improvements to **Water and Energy Efficiency Grants** funding criteria for 2017, including steps to make the criteria clearer and to emphasize the consideration given to proposals that address not only quantifiable water savings but also broader water sustainability benefits. Reclamation is also developing a new funding category, **WaterSMART Grants for Water Marketing Activities**, to provide meaningful support for entities exploring actions that can be taken to develop or facilitate water marketing that could provide a mechanism for willing participants to buy, sell, lease, or exchange water.

While interest in WaterSMART Grants continues to be strong, Reclamation has heard from a number of partners that the application process for Water and Energy Efficiency Grants is not ideal for smaller entities. With that in mind, a new funding category, **WaterSMART Grants for Small-Scale Water Efficiency Projects** will be made available in 2017. This new funding category will be used to support small-scale water management projects that have been identified through previous planning efforts. Reclamation is working to develop a streamlined selection and review process that is more appropriate for the small-scale nature of these projects.

In 2017, Reclamation is also modifying two other existing programs. To complement activities funded through WaterSMART Grants, the **Water Conservation Field Services Program** is now focused on funding for water conservation planning, System Optimization Reviews to assess potential water conservation improvements, small demonstration projects, design of water management improvements, and technical assistance. Also in 2017, Reclamation will offer a new funding opportunity under the **Cooperative Watershed Management Program**, providing cost shared funding on a competitive basis for watershed management projects that improve water quality and ecological resilience and address water quantity and quality issues at the local level to, reduce water conflicts, and to support multiple water uses within a watershed.

Finally, Reclamation continues to improve **WaterSMART Basin Studies** by increasing focus on the impact climate change may have on extreme events, such as floods and droughts, and



ecological resiliency. In addition, Reclamation began funding Basin Study Updates in 2016. The Santa Fe Basin Study Update and Saint Mary and Milk Rivers Basin Study Update will incorporate new information and update the climate change analysis and modeling tools developed in the original Basin Studies. Through these and other efforts, Reclamation will work to ensure that the Basin Studies are dynamic efforts that use the best available science to help ensure sustainable water supplies in river basins in the West.

*Stay up to date on new funding opportunity announcements and key dates each year by visiting the WaterSMART Calendar:*

<https://www.usbr.gov/watersmart/calendar.html>

These new program elements are intended to ensure that WaterSMART can continue to provide the framework Interior needs to work with partners to secure a sustainable water future for the nation. Building on the success of WaterSMART to date, Interior will continue to provide leadership and assistance to partner states, tribes, regional and local governments, and conservation organizations as a responsible steward of the Nation's natural resources.

For more information, visit <https://www.usbr.gov/watersmart>.