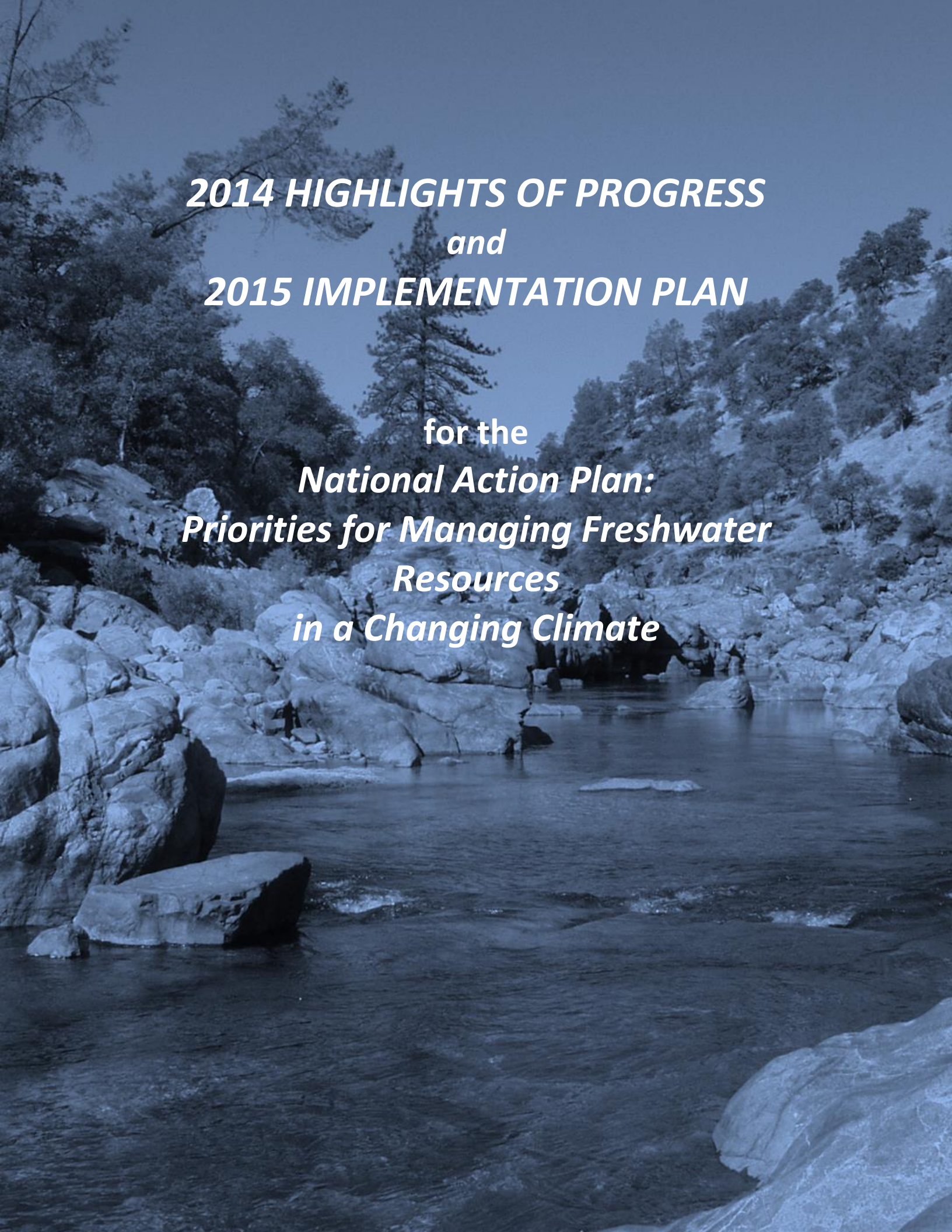


2014 HIGHLIGHTS OF PROGRESS
and
2015 IMPLEMENTATION PLAN

for the

National Action Plan:
Priorities for Managing Freshwater Resources
in a Changing Climate

Prepared by the
Water Resources and Climate Change Adaptation Workgroup

Supporting the
Council on Climate Change Preparedness and Resilience

Adopted April 7, 2015

Table of Contents

Executive Summary **1**
Examples of Progress in 2014 ..... **3**
Improve Information for Decision Making 3
Strengthen Vulnerability Assessments 4
Expand Water Use Efficiency 4
Support Integrated Water Resources Management 5
Support Training and Outreach 5
Highlights of Workplan for 2015 ..... **6**
Summary of Progress and Next Steps **6**

Recommendation 1: Establish a Planning Process and Organizational Framework **8**
2014 HIGHLIGHTS OF PROGRESS **9**
Table 2. 2015 WORKPLAN **11**

Recommendation 2: Improve Water and Climate Change Information for Decision-Making **13**
2014 HIGHLIGHTS OF PROGRESS **14**
Table 3. 2015 WORKPLAN **18**

Recommendation 3: Strengthen Assessment of Vulnerability of Water Resources to Climate Change **20**
2014 HIGHLIGHTS OF PROGRESS **21**
Table 4. 2015 WORKPLAN **23**

Recommendation 4: Expand Water Use Efficiency **25**
2014 HIGHLIGHTS OF PROGRESS **26**
Table 5. 2015 WORKPLAN **31**

Recommendation 5: Support Integrated Water Resources Management **34**
2014 HIGHLIGHTS OF PROGRESS **34**
Table 6. 2015 WORKPLAN **36**

Recommendation 6: Support Training and Outreach to Build Response Capability **37**
2014 HIGHLIGHTS OF PROGRESS **37**
Table 7. 2015 WORKPLAN **40**

Water Resources and Climate Change Adaptation Workgroup Members

Acronym List

NAME	ABBREVIATION
Advisory Committee on Water Information	ACWI
American Council for an Energy-Efficient Economy	ACEEE
American Planning Association	APA
American Water Works Association	AWWA
Appliance Standard Awareness Project	ASAP
Association of Metropolitan Water Agencies	AMWA
Climate and Natural Resources Working Group	CNRWG
Climate Change and Water Working Group	CCAWWG
Climate Resilience Evaluation and Awareness Tool	CREAT
Committee on Environment, Natural Resources, and Sustainability	CENRS
Council on Environmental Quality	CEQ
Evapotranspiration	ET
Executive Order	EO
Federal Emergency Management Agency	FEMA
National Action Plan	NAP
National Aeronautics and Space Administration	NASA
National Association of Counties	NACo
National Flood Insurance Program	NFIP
National Center for Atmospheric Research	NCAR
National Drought Resilience Partnership	NDRP
National Integrated Drought Information System	NIDIS
National Oceanic and Atmospheric Administration	NOAA
National Outbreak Reporting System	NORS
National Science and Technology Council	NSTC
National Weather Service	NWS
Natural Resource Conservation Service	NRCS
Office of Management and Budget	OMB
State Hazard Mitigation Officials	SHMO
State, Local, and Tribal Leaders Task Force	SLTLTF
Subcommittee on Water Availability and Quality	SWAQ
University Corporation for Atmospheric Research	UCAR
U.S. Army Corps of Engineers	USACE
U.S. Centers for Disease Control and Prevention	CDC
U.S. Department of Agriculture	USDA
U.S. Department of Energy	DOE
U.S. Department of the Interior	DOI
U.S. Environmental Protection Agency	EPA
U.S. Fish and Wildlife Service	USFWS
U.S. Geological Survey	USGS
U.S. Global Change Research Program	USGCRP
Water Resources Adaptation to Climate Change	WRACC
Water Utility Climate Alliance	WUCA

Executive Summary

In October 2011, the Interagency Climate Change Adaptation Task Force published a *National Action Plan: Priorities for Managing Freshwater Resources in a Changing Climate (http://www.whitehouse.gov/ sites/default/files/microsites /ceq/2011_national_action_plan.pdf)*. It was developed by the Water Resources and Climate Change Adaptation Workgroup ('the Workgroup') made up of federal agencies with responsibilities for water management. The 2011 *National Action Plan* provides an overview of the challenges that a changing climate presents for the management of the Nation's freshwater resources. It also describes federal agency actions to understand and reduce climate change risks to water resources.

The *National Action Plan* includes six core recommendations for improving water resources management in a changing climate and identifies 24 specific "Supporting Actions" that federal agencies are taking to implement it (See Table 1). The Workgroup oversees implementation of the *National Action Plan.*

This report highlights progress made in 2014 implementing the *National Action Plan* and describes the specific tasks that federal agencies are planning to undertake in 2015. It also builds on a previous report published in 2014 which described progress in 2013 and plans for 2014. This report is available at: http://acwi.gov/climate_wkg/NAP_2014_implementation_plan&2013_highlights_final3-24-14a.pdf. Taken together, the work described in this report reports reflect a comprehensive, coordinated, and continuing effort by federal agencies to respond to the challenges posed by climate change for water resources management.

It is important to note that, in a new development, the 2013 President's Action Plan and Executive Order 13653, *Preparing the United States for the Impacts of Climate Change,* replaced the previous adaptation task force with the new Council on Climate Change Preparedness and Resilience ('the Council'). Under the new Council, the Climate and Natural Resources Working Group (CNRWG) was established to consider climate change impacts on the full range of natural resources. In addition, the State, Local, and Tribal Leaders Task Force (SLT Task Force) was created to secure recommendations from stakeholders and building resilience. The water-related recommendations that came out of these forums have been integrated into this report, and we intend to more fully integrate them into future planning for FY2016 and beyond. Similarly, recommendations made by the climate subgroup of the Advisory Committee on Water Information (ACWI) have informed the thinking of the Workgroup.

Table 1 summarizes the six recommendations and 24 Supporting Actions identified in the 2011 *National Action Plan*, along with their current status.

Table 1. Summary of Recommendations and Status of Supporting Actions

Ongoing Actions; Action Substantially Complete; Action Stopped/Delayed
Recommendation 1: Establish a Planning Process
Action 1: Establish a planning process
Action 2: Establish an organizational framework
Recommendation 2: Improve Water Resources and Climate Data
Action 3: Strengthen data for understanding climate change impacts on water
Action 4: Create a program to align "hydroclimatic" statistics
Action 5: Implement surveillance system for tracking waterborne disease threats
Action 6: Provide information to identify areas likely to be inundated by sea level rise
Action 7: Expedite implementation of wetlands mapping standard
Recommendation 3: Strengthen Assessment of Vulnerability
Action 8: Provide guidance on use of modeled projections for water resource applications
Action 9: Develop an internet portal on water resources and climate change
Action 10: Develop a pilot climate change/freshwater vulnerability index
Action 11: Develop tools to build capacity for vulnerability assessments
Action 12: Assess vulnerability of National Forests and Grasslands
Action 13: Promote free and open access to water resources data
Recommendation 4: Improve Water Use Efficiency
Action 14: Develop nationally consistent metrics for water use efficiency
Action 15: Make water use efficiency an explicit consideration in the revision of Principles and Standards for water resources projects and in new NEPA guidance on climate change
Action 16: Enhance agency coordination and create a "toolbox" of water efficiency practices
Recommendation 5: Support Integrated Water Resources Management
Action 17: Strengthen the role of interstate bodies in climate change adaptation
Action 18: Revise federal water project planning standards to address climate change
Action 19: Working with States, review flood risk management and drought management planning and identify "best practices"
Action 20: Develop benchmarks for incorporating adaptive management into water project designs, operational procedures, and planning strategies
Recommendation 6: Educate Water Resource Managers and Build Capacity
Action 21: Establish a core training program on climate change science
Action 22: Focus existing youth outreach programs on climate change and water issues
Action 23: Engage land grant colleges in climate change adaptation research
Action 24: Increase graduate level fellowships in water management and climate change

Examples of Progress in 2014

Federal agencies have made steady progress in building the Nation's capacity to respond to climate change impacts on water resources. Eight of the 24 specific implementation actions identified in the 2011 *National Action Plan* are now complete and most of the remaining actions are underway. This report describes many accomplishments from 2014 across five recommendation areas:

1. Improve Information for Decision Making;
2. Strengthen Vulnerability Assessments;
3. Expand Water Use Efficiency;
4. Support Integrated Water Resources Management; and
5. Support Training and Outreach.

Key accomplishments in each of these five areas are described below.

Improve Information for Decision Making

1. Several federal agencies are providing web services to different user groups with tailored information representing a range of techniques for downscaling climate projections and hydrologic analysis. Based on downscaled climate projections from the Coupled Model Intercomparison Project Phase 5 (CMIP5-based), the following informational resources were released in 2013 and 2014:
   - U.S. Army Corps of Engineers (USACE), Bureau of Reclamation, U.S. Geological Survey (USGS), and Lawrence Livermore National Laboratory: http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/dcpInterface.html.
   - National Aeronautics and Space Administration (NASA): https://cds.nccs.nasa.gov/nex/.
   - USGS and NASA: http://regclim.coas.oregonstate.edu/gccv/index.html.
   - USGS: http://cida.usgs.gov/gdp/.
   - U.S. Global Change Research Program (USGCRP): Compendium of uses of downscaled climate data providing information germane to when different types of models should be used. See Appendix 3, Supplemental Message 6, at: http://nca2014.globalchange.gov/.

2. The U.S. Centers for Disease Control and Prevention (CDC) expanded capacity in the Great Lakes states for waterborne disease surveillance and prevention related to ambient water quality, including climate-related issues and harmful algal blooms. CDC also collaborated with state and federal partners to integrate surveillance of public health data on harmful algal blooms into the National Outbreak Reporting System (NORS).

3. USGS and the National Oceanic and Atmospheric Administration (NOAA) initiated the Climate Data Initiative and the Climate Resilience Toolkit, including a water theme, to, spur innovation and private-sector entrepreneurship and advance preparedness for the impacts of climate change. These projects catalog available tools so that end users can develop a

better understanding and plan for impacts from climate change. http://www.data.gov/climate/water/.

Strengthen Vulnerability Assessments

1. The USGS released a *National Climate Change Viewer* that allows users to interact with downscaled data at various regional, state, and local scales. http://www.usgs.gov/climate_landuse/clu_rd/apps/nccv_viewer.asp.

2. The U.S. Environmental Protection Agency (EPA) added two new components to the *Climate Resilience Evaluation and Awareness Tool* for water utilities (CREAT). The new components include: 1) an interactive map for annual total precipitation, annual average temperature, precipitation intensity for the 100-year storm, and sea-level rise; and 2) a web-based interactive map of the Atlantic and Gulf coasts that illustrates potential inundation from storm surge. For more information: www.epa.gov/climatereadyutilities.

3. EPA's Climate Ready Estuaries program published *Being Prepared for Climate Change: A Workbook for Developing Risk-Based Adaptation Plans* as a resource for environmental managers and planners, available at: http://www2.epa.gov/cre/risk-based-adaptationhttp://www2.epa.gov/cre/risk-based-adaptation.

Expand Water Use Efficiency

1. The USGS Water Census, under the umbrella of the U.S. Department of the Interior (DOI) WaterSMART initiative, has made strides in building the foundation for better assessments of water use in different sectors, including the three largest water users: municipal, agricultural, and energy: http://water.usgs.gov/watercensus/. Actions include:
    a. Released a beta version of a Data Platform that will help integrate datasets needed to help states and localities develop water budgets. See: http://water.usgs.gov/watercensus/data-products.html.
    b. In coordination with EPA, developed a site-specific water use database for 55,000 public water systems that will provide consumption profiles for each facility.
    c. U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) and the Bureau of Reclamation conducted a pilot in the Colorado River Basin with Utah State University on methods for measuring evapotranspiration (ET) in order to develop a better sense of the consumptive use associated with cropland irrigation. See: http://onlinelibrary.wiley.com/doi/10.1111/jawr.12057/abstract.
    d. Worked with the Energy Information Administration to improve the collection of water use data from thermoelectric power plants and better estimate the consumptive water use associated with power plants. See: http://pubs.usgs.gov/sir/2013/5188/pdf/sir2013-5188.pdf and http://pubs.usgs.gov/sir/2014/5184/.

2. The interagency *National Drought Resilience Partnership* was formed to facilitate access to federal drought resources and link information such as monitoring, forecasts, outlooks, and early warnings with longer-term drought resilience strategies. A "proof of concept" is being conducted with the State of Montana to demonstrate how to achieve improved drought planning and resilience.

3. The U.S. Department of Energy (DOE) issued three reports addressing the energy-water nexus: *U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather*. See: http://www.energy.gov/downloads/us-energy-sector-vulnerabilities-climate-change-and-extreme-weather; *The Water-Energy Nexus: Challenge and Opportunities.* See: http://www.energy.gov/downloads/water-energy-nexus-challenges-and-opportunities; and *Mapping water availability, projected use and cost in the western United States.* See: http://iopscience.iop.org/1748-9326/9/6/064009/article.

Support Integrated Water Resources Management

1. USACE conducted climate adaptation pilot studies that address aspects of Integrated Water Resource Management in three watersheds: Los Angeles Basin Watershed, Ohio River Basin, and West Maui Watershed. See: http://www.corpsclimate.us/rccpad.cfm.

2. A review of State Hazard Mitigation Plans was completed and published at: http://ascelibrary.org/doi/abs/10.1061/%28ASCE%29NH.1527-6996.0000063. A survey of State Hazard Mitigation Officials (SHMO) and State Floodplain Management Officials has also been completed by USACE.

3. USACE, USGS, and NOAA's National Weather Service continue to implement the *Integrated Water Resources Science and Services* project to enable an integrative national water resources information system to serve as a reliable and authoritative means for adaptive water-related planning, including to improve data interoperability and flood inundation mapping.

Support Training and Outreach

1. The Bureau of Reclamation, working with other federal agencies, the Western Water Assessment, and the University Corporation for Atmospheric Research (UCAR) COMET Program, added a module, "Water Temperature Impacts Under Climate Change" to its professional development series "Assessing Natural Systems Impacts under Climate Change" See: http://www.ccawwg.us/index.php/education/recent-training.

2. The NOAA Sectoral Applications Research Program has been providing a monthly series of webinars on climate change and water resources issues, in partnership with the National Integrated Drought Information System (NIDIS), Water Research Foundation, Water Environment Federation (WEF), Water Environment Research Foundation (WERF),

and American Water Works Association (AWWA). See: http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/SARPProgram/WebinarsandWorkshops.aspx.

3. EPA is providing technical assistance to 20 communities to develop comprehensive climate-related risk assessments for drinking water and wastewater utilities using CREAT.

Highlights of Workplan for 2015

Federal agencies continue to work aggressively to develop and deliver tools, information and support to States, Tribes and local communities. Some examples of the many activities described in this report that will be undertaken in 2015 include:

- ✓ USGS will work with stakeholders to conduct three projects as part of the Open Water Data Initiative, including a national flood interoperability experiment, data sharing to support regional water supply/drought decision making, and data sharing to support chemical spill response.
- ✓ EPA and USGS will modernize methods for calculating low flow statistics for evaluating water quality impacts of climate change.
- ✓ USDA will assess agricultural water use efficiency in the Ogallala Aquifer as part of ongoing efforts to evaluate agricultural conservation programs.
- ✓ The Bureau of Reclamation, working with several other federal agencies, will add additional modules to the curriculum: *Assessing Natural Systems Impacts under Climate Change*, including: (1) Sedimentation Impacts under Climate Change, and (2) Hydrology Impacts - Virtual Module.
- ✓ The U.S. Fish and Wildlife Service (FWS) National Conservation Training Center will begin training natural resource managers across the country in climate smart conservation using the *Climate Smart Conservation Guide* that describes practices to safeguard vital natural resources in a changing climate.
- ✓ NOAA, USDA, and DOI will lead an effort to define a framework for education and training to build climate literacy and capability among relevant technical service providers, such as planners, engineers, and consultants, and federal agency staff.

Summary of Progress and Next Steps

As a result of three years of implementation efforts, federal agencies have been able to complete or substantially implement eight of the 24 specific supporting actions identified in the *National Action Plan*. Specifically, the Workgroup considers the following actions identified below to be substantially complete, although some work to keep the actions current may continue:

- ✓ **Supporting Action 1:** Establish a planning process with the capability to identify priority adaptation actions and promote their implementation;

- ✓ **Supporting Action 2:** Establish an organizational framework to promote effective management of water resources in a changing climate**;**
- ✓ **Supporting Action 7**: Establish interagency effort to expedite implementation of the newly developed wetlands mapping standard;
- ✓ **Supporting Action 9:** Develop an internet portal on water resources and climate change;
- ✓ **Supporting Action 15:** Make water use efficiency an explicit consideration in the revision of Principles, Requirements, and Guidelines for water resources projects;
- ✓ **Supporting Action 18**: Revise federal water project planning standards to address climate change;
- ✓ **Supporting Action 19:** Working with states, review flood risk management and drought management planning to identify "best practices" to prepare for hydrologic extremes;
- ✓ **Supporting Action 20:** Develop benchmarks for incorporating adaptive management into water project designs, operational procedures, and planning strategies.

In addition, efforts to advance implementation of the supporting actions in very difficult budget circumstances has resulted in agencies and the Workgroup as a whole deferring three of the planned actions. The following actions will be reconsidered in the FY16 planning process:

- × **Supporting Action 10:** Develop a pilot climate change vulnerability index for a major category of water facilities;
- × **Supporting Action 23:** Engage Water Resources Research Institutes at land grant colleges in climate change adaptation research; and
- × **Supporting Action 24:** Increase graduate fellowships in water management and climate change.

In 2015, the Workgroup will review the six recommendations and progress to date in order to refresh priority goals and objectives to guide future work on water resources and climate change. In doing so, the Workgroup will examine the results of the many activities that have taken place over the past six years resulting from the Interagency Climate Change Adaptation Workgroup, the President's Climate Action Plan and related workgroups, the 2013 National Climate Assessment, and stakeholder inputs such as ACWI, to name a few.

Recommendation 1: Establish a Planning Process and Organizational Framework

The *National Action Plan* was an initial step to respond to the challenges to freshwater resource management posed by a changing climate. In order to ensure continuity of planning and to facilitate ongoing coordination between agencies, the Workgroup maintains a formal organizational framework. The Workgroup also serves to strengthen links between federal agencies and state, tribal and local governments and other interested parties. The current framework is comprised of three co-chairs from USGS, EPA, and the Council on Environmental Quality (CEQ), serving as the management team. The co-chairs worked with five Team Leaders to implement actions under Recommendation 1.

Recommendation 1 Actions

Action 1: Establish a planning process with the capability to identify priority adaptation actions and promote their implementation. **(COMPLETE)**
Action 2: Establish an organizational framework to promote effective management of water resources in a changing climate. **(COMPLETE)**

The co-chairs believe that the initial tasks of establishing a planning process and organizational framework have been successfully completed. Going forward, the Workgroup will continue to use this organizational framework for ongoing planning and to provide continuity for evolving federal processes.

For example, the organizational and planning process described has already evolved with new interagency initiatives related to the 2013 President's Climate Action Plan and the new Climate Change Executive Order (EO) 13653. The Climate Change Preparedness and Resilience Council ('the Council') established under EO 13653 created several working groups including one focused on natural resources (land and water) as well as a State, Local, and Tribal Leaders Task Force. This Workgroup provided input to these groups.

In October 2014, the Council published: *Priority Agenda: Enhancing the Climate Resilience of America's Natural Resources ('Priority Agenda')*. This report identifies four key themes related to natural resources and climate change:

- Foster Climate Resilient Lands and Waters;
- Manage and Enhance U.S. Carbon Stocks;
- Enhance Community Preparedness and Resilience by Utilizing and Sustaining Natural Resources; and
- Modernize Federal Programs, Investments, and Delivery of Services.

Each of these four themes identifies specific actions to be implemented by federal agencies. Some of these actions are related to freshwater resources and have been developed in conjunction with the continued implementation of the *National Action Plan.*

Also in response to EO 13653, the President's State, Local and Tribal Leaders' Task Force published a report in November 2014 providing a range of climate adaptation recommendations, including recommendations related to freshwater resources that are consistent with the recommended actions in the *National Action Plan*. For example, the Task Force recommended:

- Expanded use of green and natural infrastructure;
- Providing data and tools to guide local decision-makers; and
- Promoting integrated watershed management and planning.

A major challenge for the Workgroup in 2015 is to continue to implement the key actions identified in the *National Action Plan* while overseeing the integration of new concepts and actions arising from the reports of the President's Task Force and the *Priority Agenda*.

In addition, the Workgroup recognizes that the *National Action Plan* was developed in 2010 and 2011, and that substantial new information and data concerning water resources and climate change is now available from the National Climate Assessment and other sources. Further, a substantial part of the work called for in the *National Action Plan* is now complete or will be completed in 2015. New ideas from the President's Task Force and the *Priority Agenda* need to be integrated into work to implement the *National Action Plan*. Next steps in adapting management of freshwater resources to a changing climate are also included in a report of the Advisory Committee on Water Information (ACWI) Climate Change Workgroup. To account for the evolution of thinking concerning freshwater resources and climate change, the Workgroup will update the *National Action Plan* in the spring of 2015 and finalize this work by the spring of 2016.

2014 HIGHLIGHTS OF PROGRESS

Key accomplishments in 2014 related to Recommendation 1 include the following:

1.1. Publish 2013 *Highlights of Progress*: In March 2014, the Workgroup published an annual progress report describing actions to implement the *National Action Plan*; see

http://acwi.gov/climate_wkg/NAP_2014_implementation_plan&2013_highlights_final3-24-14a.pdf.

1.2. Publish *2014 Workplan*: In March 2014, the Workgroup published a workplan describing actions to be implemented to advance the work described in the *National Action Plan*; see http://acwi.gov/climate_wkg/NAP_2014_implementation_plan&2013_highlights_final3-24-14a.pdf.

1.3. Hold Regular Workgroup Meetings: The Climate Change and Water Resources Workgroup met frequently in 2014. In these meetings, agencies exchanged information concerning developments related to climate change adaptation, coordinated related projects, and reviewed of progress related to implementing the *National Action Plan*.

1.4. Coordinate with Related Climate Change and Water Plans and Projects: Throughout 2014, the Workgroup participated in a variety of programs and projects including:

- Contributed to the President's *Climate Action Plan* and subsequent development of the Climate Change Preparedness Executive Order, released in November 2013;
- Participated in developing the report of the Council's Climate and Natural Resources Workgroup;
- Coordinated on the water-related elements of the *National Fish, Wildlife and Plants Climate Change Adaptation Strategy; and*
- Reviewed and commented on agencies' climate change adaptation strategies to provide input to CEQ as it created guidance to agencies for improving strategies.

1.5. Cooperate with the National Science and Technology Council (NSTC) Committee on Environment, Natural Resources, and Sustainability's (CENRS), Subcommittee on Water Availability and Quality (SWAQ): Throughout 2014, the Workgroup co-chairs and members participated in monthly meetings of the Committee on the Environment, Natural Resources, and Sustainability's SWAQ.

1.6. Support Operation of External Stakeholder Federal Advisory Workgroup: The Advisory Committee on Water Information (ACWI) is a Federal Advisory Committee that provides advice and guidance to federal agencies on water issues. The *National Action Plan* includes a recommendation that ACWI serve as a vehicle for engaging stakeholders on climate change and water issues. Members of the Climate Change Workgroup of ACWI represent 26 organizations from states, tribes, and public interest groups along with 14 federal agencies. EPA is the federal agency co-chair of the Workgroup and WEF is the non-federal co-chair.

In 2014, ACWI's Climate Change Workgroup met monthly and provided feedback on the *National Action Plan*, culminating in publication of a report recommending next steps. See: http://acwi.gov/climate_wkg/Climate_water_recommendations_rpt-april_21_2014_final_draft.pdf. Other materials related to the Workgroup, including a report describing actions in 2014, are posted at: http://acwi.gov/climate_wkg.

WICP Water Information Coordination Program
ACWI Advisory Committee on Water Information

Table 2. 2015 WORKPLAN
Recommendation 1: Establish a Planning Process and Organizational Framework

Task Number	Task	Projected Completion
1	Publish final 2014 Highlights of Progress report and 2015 Workplan after providing for review and comment by ACWI Climate Workgroup.	April
2	Support the Resilience Council and participate in interagency work to implement the *Priority Agenda: Enhancing the Climate Resilience of America's Natural Resources* and the report of the President's State, Local and Tribal Leaders' Task Force on Climate Preparedness and Resilience.	Ongoing
3	Outreach to federal agency officials as they implement agency-specific climate change adaptation plans where agency actions are related to actions in the *National Action Plan.*	Ongoing
4	Produce an update of the *National Action Plan* that takes into consideration progress since 2010 and incorporates new activity in federal agencies to build climate resilience in the water sector.	Spring 2016
5	Continue Water Resources Workgroup meetings to share information concerning agency work and implementation of the *National Action Plan.*	Monthly
6	Continue to work with and support the Climate Change and Water Resources Workgroup of ACWI to hear comments and suggestions related to the need for federal actions, including actions to implement the EO 13653.	Ongoing
7	Participate in meetings of the SWAQ and provide comments on climate change related reports.	Ongoing
8	Coordinate with the Joint Implementation Working Group (JWIG) to implement the *National Fish, Wildlife and Plants Climate Change Adaptation Strategy.*	Ongoing

9	Coordinate with efforts to implement the climate change elements of the Implementation Plan for the *National Ocean Policy*.	Ongoing
10	Participate in CCAWWG activities and provide comments on products.	Ongoing
11	Coordinate with development of regional collaborations on climate change science and services [Supports CNRWG Priority B].	Ongoing

Water-related priorities and recommendations derived from the Climate and Natural Resources Working Group (CNRWG) and the State, Local, and Tribal Leaders Task Force (SLTLTF) are described below as applicable to Recommendation 1 – Establish a Planning Process and Organizational Framework.

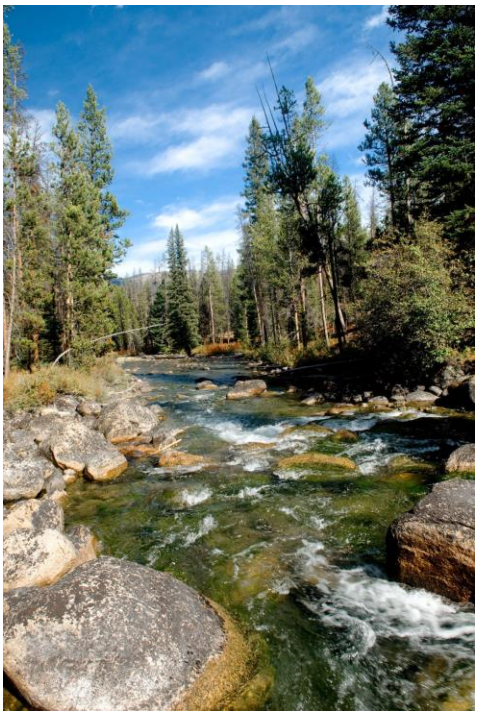
Stakeholder Priorities and Recommendations		
A.	State, Local, Tribal Leaders Task Force Recommendation	*Federal agencies including EPA, USACE, DOI, and USDA will work together to support watershed restoration, groundwater partnerships, water (storm and waste) reclamation and reuse, and water conservation. Establish regional interagency water security partnerships that include state, local, and tribal representatives.*
B.	CNRWG Priority Action Related to Task 11	*Federal agencies will work with state, tribal, and local partners to identify appropriate regional associations dealing with water resources management and develop federal agency support teams, comparable to the existing WestFAST partnership.*

Recommendation 2: Improve Water and Climate Change Information for Decision-Making

Current decision-making tools and policies for water resources management rely on historical water data to estimate future variations in water availability and quality. In a changing climate, however, as the hydrological cycle undergoes changes due to alternations in the climate, water data and models used in decision-making need to be reevaluated and updated. In addition, new insights from predictive models and vulnerability and assessment tools need to be applied to key decisions.

Recommendation 2 Actions

Action 3: Strengthen data for understanding climate change impacts on water.
Action 4: Create a program to align "hydroclimatic" statistics with today's climate and anticipate future changes.
Action 5: Implement an active, reliable surveillance system for tracking waterborne disease and public health threats relevant to climate change.
Action 6: Provide coastal states and communities with essential information to identify areas likely to be inundated by sea level rise.
Action 7: Establish interagency effort to expedite implementation of the newly developed wetlands mapping standard. **(COMPLETE)**



In 2014, the Advisory Committee on Water Information (ACWI) Water Resources Adaptation to Climate Change Workgroup made three recommendations related to water data and information in support of climate change decision-making. The Workgroup initiated several new activities that support the ACWI recommendations. Looking forward, the recommendations provide an opportunity to reframe a number of the supporting actions identified in the *National Action Plan*.

The ACWI recommendations being considered are:

ACWI Recommendation 1: Ensure continuity and viability of long-term hydro-climate observations and data management systems by establishing a coordinated process in which each federal agency develops a plan and budget for its key observing system(s) showing how that agency will dedicate resources to evaluate data and information adequacy and then sustain and upgrade its system(s) to meet those needs.

ACWI Recommendation 2: Enhance data access and interoperability of data systems, including encouraging the SWAQ to develop and oversee implementation of a plan for improved water data access and interoperability across agency boundaries. This includes the development of an integrative tool to improve access to data and information from multiple sources.

ACWI Recommendation 3: Bolster critical data sets, including those related to groundwater, stream/river flow, health data (waterborne disease), water use, and paleoclimate reconstruction.

The Data and Information Team, led by EPA, manages the implementation of actions and tasks to support Recommendation 2 in conjunction with the agency members of the Workgroup.

2014 HIGHLIGHTS OF PROGRESS

Key accomplishments in 2014 related to Recommendation 2 include:

2.1. Enhance Community Access to Future Climate and Hydrology Projections: In 2014, federal agencies – USGS, Bureau of Reclamation, USACE, NASA Ames Research Center, the National Center for Atmospheric Research (NCAR), and DOE Lawrence Livermore National Laboratory continued to partner with and non-federal organizations – Santa Clara University, Scripps Institution of Oceanography, Climate Analytics Group, and Climate Central. Collectively they have been developing and producing new downscaled climate and hydrologic projections for the water resources adaptation community, translated from CMIP5 global climate projections. The various activities complement each other by offering data resources and web-services that serve different user groups and their tailored information interests in various ways. The activities also represent a range of techniques for climate projections downscaling and hydrologic analysis. Notable CMIP5-based information releases in 2013 and 2014 include the following.

1. USACE, Bureau of Reclamation, USGS, and Lawrence Livermore National Laboratory: http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/dcpInterface.html;
2. NASA: https://cds.nccs.nasa.gov/nex/;
3. USGS and NASA Ames: http://regclim.coas.oregonstate.edu/gccv/index.html;
4. USGS: http://cida.usgs.gov/gdp/; and
5. The US Global Change Research Program: compendium of uses of downscaled climate data as part of the 2014 National Climate Assessment. See Appendix 3, Supplemental Message 6 for specific information on models and downscaling as well as information germane to when different types of models should be used. http://nca2014.globalchange.gov/.

2.2. Publish the National Climate Assessment (NCA) Water Resources Chapter: USGS and USACE co-led the development of a technical input report to the National Climate Assessment's water resources chapter which summarized current observations of effects of

climate change on the water cycle, anticipated effects based on climate modeling, and identified adaptation strategies. This report is available at: http://www.iwr.usace.army.mil/Portals/70/docs/iwrreports/2013-R-10_Water_Resources_Sector_TIR.pdf. The report served as a key input to the water resources Chapter of the National Climate Assessment released in 2014. In 2015, a more comprehensive version of the technical input report will be published as a USGS Circular. The National Climate Assessment water resources chapter is available at: http://nca2014.globalchange.gov/report/sectors/water.

2.3. Study of Climate Change in 20 Watersheds: EPA released a final report titled, *Watershed Modeling to Assess the Sensitivity of Streamflow, Nutrient, and Sediment Loads to Potential Climate Change and Urban Development in 20 U.S. Watersheds*. This document characterizes the sensitivity of streamflow, nutrients and sediment loading in different regions of the nation to a range of plausible mid-21st Century climate change and urban development scenarios. Sensitivity studies evaluating different methodological choices help to improve the scientific foundation for conducting climate change impacts' assessments. This report is available at: http://cfpub.epa.gov/ncea/global/recordisplay.cfm?deid=256912.

2.4. Continue funding for waterborne disease prevention capacity in Arizona, Florida, Ohio, South Carolina, Washington, New Hampshire, Louisiana, and Maine: CDC continued to support waterborne disease surveillance activities in eight states during 2014 through its Epidemiology and Laboratory Capacity grant program and saw expansion of funding to seven more: Colorado, Maryland, Oklahoma, Oregon, Tennessee, Virginia, and Wisconsin.

2.5. Expand waterborne disease surveillance capacity in the Great Lakes states to focus on waterborne disease surveillance and prevention issues related to ambient water quality: Great Lakes Restoration Initiative funding was used to hire three new Council of State and Territorial Epidemiology (CSTE) Applied Epidemiology Fellows and match them with Illinois, Michigan, and New York state health departments. The Fellows will work on water and health issues in the Great Lakes region, including climate-related issues and harmful algal blooms. Four Fellows were matched in 2013 with placements in Indiana, Minnesota, Ohio, and Wisconsin.

2.6. Collaborate with state and federal partners to integrate surveillance of public health data on harmful algal blooms into NORS, CDC's largest electronic outbreak reporting system: A new state and federal working group provided guidance on integration of harmful algal bloom-associated illness and event reporting into NORS. This work included a NOAA-sponsored workshop convened in March 2014.

2.7. Use LiDAR data from before and after Hurricane Sandy to improve NOAA and Federal Emergency Management Agency (FEMA) surge forecast models: Prior to Hurricane Sandy, USGS and NOAA conducted LiDAR shoreline mapping from North Carolina to New York. See http://coastal.er.usgs.gov/hurricanes/sandy/. Immediately following Hurricane Sandy's

landfall, the mapping was repeated in order to document the impact of major storms on shoreline change. See https://water.usgs.gov/floods/events/2012/sandy/). In addition, USGS mapped high-water levels resulting from Sandy at more than 1,000 points in the impact zone. These data, along with data from more than 200 Recording Water Level Gages, are being used to document the magnitude and extent of inundation and to improve NOAA and FEMA surge forecast models. Reports relevant to these activities are available at: http://www.usgs.gov/hurricane/sandy/#publications.html.

2.8. Publish online the final digitized version of the wetlands data layer of the National Spatial Data Infrastructure (NSDI) for the conterminous U.S., Hawaii, Puerto Rico and the Virgin Islands. Continue work to finalize wetland mapping for Alaska: FWS provides stewardship for the wetlands data that comprise the wetlands layer of the NSDI. In partnership with the USGS, FWS has made these data available via the Internet (http://www.fws.gov/wetlands/Data/). All digital wetlands data are provided in a seamless format for the conterminous United States and its territories. This provides resource managers and the general public with digital wetland information that can be used in geographic information systems. As of 2014, the FWS Wetlands Geodatabase contains map data for the entire conterminous 48 States, the windward islands of Hawaii, Puerto Rico, the Virgin Islands, Guam, the major Northern Mariana Islands and 35% of Alaska.

2.9. Climate Data and Tools (CDAT): USGS and NOAA initiated an effort in 2014 to catalog existing federal water data and tools related to climate. The catalog supports two aspects of the President's Climate Action Plan, including the Climate Data Initiative (CDI) and the Climate Resilience Toolkit. A water theme was added to the Climate Data initiative in December 2014; see http://climate.data.gov. The CDI leverages extensive open federal data to spur innovation and private-sector entrepreneurship in order to advance awareness of and preparedness for the impacts of climate change. The initial holdings, which include over 125 datasets, maps, tools and featured content, may be found on climate.data.gov/water. In addition, there are a number of private sector commitment leads that have been initiated. The Climate Resilience Toolkit complements the CDI by providing a catalog of available tools that can be used to better understand and plan for impacts from climate change. Work began in 2014 to develop the water theme for the Toolkit, which will be available online with other toolkits at: http://toolkit.climate.gov/. The water theme is co-chaired by USGS and NOAA.

2.10. Soil Moisture Network: The President's Climate Action Plan outlined the need for a coordinated National Soil Moisture Network (NSMN). Soil moisture data are critical for accurate drought prediction, flood forecasting, climate modeling, prediction of crop yields and water budgeting. However, soil moisture data are collected by many agencies and organizations in the United States using a variety of instruments and methods for varying applications. These data are often distributed and represented in disparate formats, posing significant challenges for use. In response to this action plan, a team led by the National Integrated Drought Information System (NIDIS) and made up of representatives from numerous federal, State and university groups has begun to develop a framework for the

NSMN and has instituted a proof-of-concept pilot study. This pilot is located in the south-central plains of the U.S., and will serve as reference architecture for the requisite data systems and inform the design of the national network. The pilot comprises both in-situ and modeled soil moisture datasets (historical and real-time) and will serve the following use cases: operational drought monitoring, experimental land surface modeling, and operational hydrological modeling.

2.11. Open Water Data Initiative (OWDI): In 2014, The Subcommittee on Spatial Water Data of ACWI in collaboration with the Federal Geospatial Data Committee (FGDC) initiated an effort to integrate currently fragmented water information into a connected, national water data framework and leverage existing systems, infrastructure and tools to underpin innovation, modeling, data sharing, and solution development. The OWDI will build upon data and tool catalogs that are being compiled as part of the CDAT project described above as well as the work already completed as part of the Integrated Water Resources Science and Service (IWRSS) project that will integrate water information between USGS, USACE, and NOAA. This is a multi-year effort, with both short-term and long-term activities. More information on the OWDI can be found at: http://acwi.gov/spatial/index.html.

2.12. Modernize Flow Statistics: In 2014, EPA and USGS initiated a joint project to modernize the calculation of low flow statistics for both gaged and ungaged rivers that are commonly used in water quality programs. It will enable water quality managers to have readily accessible methods to more accurately evaluate flow statistics based on observational data. The project includes an evaluation of the implications of changing flows due to climate impacts.

Table 3. 2015 WORKPLAN
Recommendation 2: Improve Water and Climate Change Information for Decision-Making

Task Number	Task	Projected Completion
1	Release the water theme in the Climate Resiliency Toolkit and update the catalog of water data sets within http://climate.data.gov.	Summer 2015
2	Work with ACWI to conduct three activities as part of the Open Water Data Initiative, including 1) a national flood interoperability experiment; 2) an effort to enable data sharing to support regional water supply/drought decision making; and 3) an effort to explore water quality data sharing needs in support of chemical spill response. [Supports CNRWG Priority C.]	Fall 2015
3	Develop a data sharing strategy to guide approaches for sharing data collected using water quality sensors from multiple partners in common formats.	Fall 2015
4	Continue working to finalize National Spatial Data Infrastructure (NSDI) wetland mapping for Alaska. [Supports CNRWG Priority D.]	Ongoing
5	Continue to provide funding to states for waterborne disease prevention capacity; strengthen public health capacity for water and climate change through expanded state and federal partnerships; and collaborate with partners to launch a new electronic reporting system for public health data on harmful algal bloom events, including human and animal illnesses.	Ongoing
6	Expand state waterborne disease surveillance capacity in Great Lakes basin states to improve disease surveillance systems, develop waterborne disease surveillance and response networks, and improve public health capacity for ambient water issues, such as harmful algal bloom events and illnesses. Match four new Council of State and Territorial Epidemiology Applied Epidemiology Fellows in Indiana, Minnesota, Ohio, and Wisconsin to replace the 2013 Fellows complete their rotation.	Ongoing
7	Collaborate with state and federal partners to launch a new electronic reporting system for public health data on harmful algal bloom events, including human and animal illnesses.	Ongoing
8	Strengthen public health capacity for water and climate change issues through new or expanded state and federal partnerships.	Ongoing
9	Modernize statistical methods used to calculate low flow. Assess utility methods for evaluating impacts of climate change.	Fall 2015

Water-related priorities and recommendations derived from the Climate and Natural Resources Working Group (CNRWG) and the State, Local, and Tribal Leaders Task Force (SLTLTF) are described below as applicable to Recommendation 2 – Improve Water and Climate Change Information for Decision-Making.

Stakeholder Priorities and Recommendations		
C.	CNRWG Priority Related to Task 2	*NOAA's National Weather Service National Water Center, with partners, will begin development of a national water model that will improve water prediction capability to optimize communities' use of increasingly limited water resources.*
D.	CNRWG Priority Related to Task 4	*USGS will collaborate with DOI resource management agencies to provide science support for wetland management and restoration actions.*

Recommendation 3: Strengthen Assessment of Vulnerability of Water Resources to Climate Change

Extreme weather events, sea level rise, shifting precipitation and runoff patterns, temperature changes, and resulting changes in water quality and availability all have potentially significant implications for the operations of water sector utilities. To adapt to climate change, water resource managers must first determine the degrees of risk and vulnerability in their systems.

Throughout 2014, the Vulnerability Assessment Team, led by NOAA, managed the implementation of actions and tasks to support this recommendation in conjunction with the agency members of the Workgroup. Each agency has significant work underway. Given the variation in timeframes for each action, ongoing coordination and collaboration keep partner agencies aware of efforts and provide significant benefits to stakeholders.

Recommendation 3 Actions

Supporting Action 8: Publish long-term plan for federal downscaling of climate model projections.
Supporting Action 9: Develop a federal internet portal to provide information on water resources and climate change. **(COMPLETE)**
Supporting Action 10: Develop a pilot climate change vulnerability index for a major category of water facilities. **(POSTPONED)**
Supporting Action 11: Continue development of tools and approaches that build capacity for water institutions to conduct vulnerability assessments and implement responses.
Supporting Action 12: Assess vulnerability of watersheds and aquatic systems on National Forests and Grasslands.
Supporting Action 13: Promote free and open access to authoritative climate change-science and water resources data.

Existing efforts to develop vulnerability tools have focused on categories of infrastructure and operations that may be at risk as a result of climate change. Water sector infrastructure is often critical to protecting human health, life and property. In the future, more attention will be needed to address vulnerability assessment tools for ecosystems and the services they provide.

2014 HIGHLIGHTS OF PROGRESS

Key accomplishments in 2014 related to Recommendation 3 include:

3.1. **National Climate Change Viewer:** In May 2014, USGS released a National Climate Change Viewer that allows users to interact with downscaled data at various regional, state, and local scales around the country. It also provides time series information and download capabilities. Available at: http://www.usgs.gov/climate_landuse/clu_rd/apps/nccv_viewer.asp.

3.2. **Climate Ready Water Utilities Tools:** EPA continues to develop tools to support water resource managers to evaluate potential impacts and build resilience to climate change. Recent products, available at: www.epa.gov/climatereadyutilities, include:

a. *Scenario Projection Mapping:* a scenario-based map of projected changes from CREAT. The mapping technology provides easy to access to scenarios of projected changes and an interactive map for annual total precipitation, annual average temperature, precipitation intensity for the 100-year storm, and sea-level rise.
b. *Storm Surge Mapping:* EPA, working with NOAA's National Hurricane Center, has created a web-based interactive map of the Atlantic and Gulf coasts that illustrates potential inundation from storm surge. The mapping tool displays NOAA's Sea, Lake, and Overland Surge from Hurricanes model, as well as FEMA's 100-year and 500-year flood zones. EPA plans to incorporate historical hurricane location strike data into the next version of the tool.
c. *Stormwater Calculator:* CREAT is now integrated with a new Stormwater Calculator that enables users to run alternative scenarios to evaluate how they can add green infrastructure into their plans to reduce runoff.
d. *Water Utility Climate Resilience Support Projects:* EPA selected more than 20 drinking water and wastewater utilities for comprehensive climate-related risk assessments using CREAT. EPA will provide technical assessment assistance to the participating utilities, which will help identify adaptation strategies for implementation to bolster climate readiness and resilience.

3.3. **Workbook for Watershed-Based Climate Change Vulnerability Assessments and Adaptation Plans:** In September 2014, EPA's Climate Ready Estuaries published *Being Prepared for Climate Change: A Workbook for Developing Risk-Based Adaptation Plans* as a resource for environmental managers and planners. This publication provides much needed guidance for conducting risk-based climate change vulnerability assessments and developing adaptation action plans. The workbook helps users to identify, analyze and prioritize climate change risks. In developing an action plan, it guides users to address their most pressing risks and find appropriate responses. By using the workbook and addressing

climate change in their systems, users will be ready to protect environmental resources, public safety, and infrastructure. Available at: http://www2.epa.gov/cre/risk-based-adaptationhttp://www2.epa.gov/cre/risk-based-adaptation.

3.4. **Federal Support Toolbox for Integrated Water Resources Management (IWRM):** USACE developed a "Toolbox" that provides a comprehensive hub of information and capabilities through a common data portal across federal agencies. The Toolbox provides states, tribes, federal, regional, and local water resources agencies with access to federal water resources information, planning assistance, and capabilities to optimize the planning and management of water. The Toolbox includes climate change information and takes advantage of current activities in improving hydrostatistics, new information available through the National Climate Assessment, data integration mechanisms such as the Hydrologic Information System (HIS) developed by the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI), and data visualization techniques such as those developed for "CalAdapt" by the California Energy Commission and the California Natural Resources Agency. The Toolbox provides links to other climate information and collaborative activities such as the NOAA Climate Portal. The Toolbox is available at: http://watertoolbox.us.

3.5. **Report on National Forest Watershed Vulnerability Assessments:** In 2014, the Forest Service continued its vulnerability assessment pilots in National Forests, with the release of the vulnerability assessment for the Minnesota forest ecosystem, bringing the total of forests assessed to twelve. The pilot efforts identified key principles important to conducting future vulnerability assessments, and contribute directly to the Forest Service Watershed Condition Framework, a systematic, six-step process for determining watershed condition class that all National Forests and Grasslands can apply consistently. Documentation of these efforts is available at: http://www.fs.fed.us/publications/watershed/Watershed_Condition_Framework.pdf.

3.6. **Great Dismal Swamp Ecosystem Resilience Pilots** During 2014, USGS initiated two pilot projects with FWS in the Great Dismal Swamp National Wildlife Refuge. The first project will consider the impacts of management decisions on carbon stocks and fluxes as well as impacts on resilience and ecosystem services, such as water quality, flood risk reduction, wildlife viewing, cultural heritage, and nutrient cycling. The second project will develop a tool helping resource managers consider the impacts of management decisions on ecosystem resilience and services. See: http://www.usgs.gov/climate_landuse/lcs/great_dismal_swamp/.

3.7. **President's Climate Data Initiative (CDI) Water Theme:** The water theme was launched in December 2014, as one part of the President's Climate Data and Tools Initiative. The CDI leverages extensive open federal data to spur innovation and private-sector entrepreneurship in order to advance awareness of and preparedness for the impacts of climate change. Holdings include over 125 datasets, maps, tools and featured content are found at: climate.data.gov/water. In addition, there are a number of private sector

commitments that have been initiated. The CDAT water theme is co-chaired by USGS and NOAA. More information is available at: https://www.data.gov/water/.

Table 4. 2015 WORKPLAN
Strengthen Assessment of Vulnerability of Water Resources to Climate Change

Task Number	Task	Projected Completion
1	FEMA intends to use the findings of a 2013 study to make recommendations for addressing the impacts of climate change and future development, caused by population growth, on the National Flood Insurance Program. The 2013 study, *The Impact of Climate Change and Population Growth on the National Flood Insurance Program*, is available at: http://www.aecom.com/deployedfiles/Internet/News/Sustainability/FEMA%20Climate%20Change%20Report/Climate_Change_Report_AECOM_2013-06-11.pdf.	2015
2	In order to more fully understand and integrate best practices for downscaling climate data across the Federal Government, the USGCRP is convening a workshop in spring 2015. Invitees will include federal partners who use downscaled climate information as part of their work and those who provide downscaled climate information to the public or private sectors.	Spring 2015
3	USGS is developing the Climate Registry on the Assessment of Vulnerability (CRAVe) to better understand impacts of climate change on wildlife, ecosystems, and other resources. The registry will collect and display information (metadata) on climate change vulnerability assessment projects from across the country, pooling examples from federal, state, local, and tribal governments.	2015
4	In 2015, the President's Climate Resilience Toolkit Water Theme will be released. The online Climate Resilience Toolkit (CRT) will put in one location access to information on the use of data-driven resilience tools and services as well as highlight best practices. The toolkit will provide narratives, videos etc. to help decision makers better understand how others faced with a climate-related problem are finding solutions to become more resilient. The information on this site will be formatted to excite and inform the reader rather than as a typical report. [Supports CNRWG Priority E].	2015
5	EPA will provide technical assistance to at least 25 communities to help them adopt Green Infrastructure practices to improve stormwater management under climate change and to achieve a range of community objectives. [Supports CNRWG and SLTLTF Priority F].	

Water-related priorities and recommendations derived from the Climate and Natural Resources Working Group (CNRWG) and the State, Local, and Tribal Leaders Task Force (SLTLTF) are described below as applicable to Recommendation 3 – Strengthen Assessment of Vulnerability of Water Resources to Climate Change.

Stakeholder Priorities and Recommendations		
E.	CNRWG Priority Related to Task 4	*NOAA, USDA, and DOI, in coordination with other federal agencies, will improve customer service by providing an online "front door" to the array of regional information, services, and tools available, using the National Climate Assessment regions as a consistent framework. These agencies will also develop a networked approach whereby access to any one agency's regional services will provide a clear path to the others.*
F.	CNRWG and SLTLTF Priority Related to Task 5	*EPA will provide technical assistance to at least 25 communities to help them adopt Green Infrastructure practices to improve stormwater management under climate change and to achieve a range of community objectives.*
G.	CNRWG Priority	*Under DOI's leadership, federal agencies will work with partners to select and map flagship geographic regions for which they will identify priority areas for conservation, restoration, or other investments to build resilience in vulnerable regions, enhance carbon storage capacity, and support management needs.*
H.	State, Local Tribal Leaders Task Force Recommendation	*Support and incentivize water resource planning and management. Provide technical support and guidance on how to conduct assessments of the vulnerability of water infrastructure to climate change impacts and incorporate climate change resilience into water resource planning and related economic development planning.*
I.	State, Local Tribal Leaders Task Force Recommendation	*Support climate resilience as part of coastal infrastructure planning and investments. The USACE should conduct coastal climate vulnerability assessments of all of its districts and disseminate this information to communities to enable cross-jurisdictional resilience planning.*

Recommendation 4: Expand Water Use Efficiency

Climate change will further challenge water resources that are already under stress because of growing populations, contamination, and demands to meet diverse human and ecosystem needs. Making more efficient use of water can extend the availability of current supplies, reduce competition among sectors, save energy, and reduce the cost of water system operations.

The Water Use Efficiency team established three supporting actions for this effort. See Recommendation 4 actions below. These supporting actions are in various stages of implementation. Progress on some of the specific actions has been slow, but other priority activities are underway in each agency to successfully further the goals of Recommendation 4. These other activities are either directly furthering water use efficiency or laying a foundation for future efforts.

Recommendation 4 Actions

Supporting Action 14: Develop nationally consistent metrics for water use efficiency in key sectors and report water efficiency information in nationally consistent formats.
Supporting Action 15: Make water use efficiency an explicit consideration in the revision of Principles, Requirements and Guidelines for water resources projects **(COMPLETE)** and in new NEPA guidance on climate change.
Supporting Action 16: Enhance coordination among federal water efficiency programs and improve program effectiveness.

The ACWI subcommittee, the Water Resources Adaptation to Climate Change Workgroup, provided recommendations on elements of the *National Action Plan* in 2014. The subgroup that focused on water use efficiency made three recommendations: (1) Prioritize agriculture for consideration under Supporting Action 14 of the *National Action Plan*; (2) Update DOE efficiency standards for plumbing products; and (3) Promote programs and legislation to develop a national funding program for water efficiency and reuse/reclamation that would mirror, but not replace, existing programs managed in western States by the Bureau of Reclamation.

The team will take the first recommendation under advisement as it carries out activities in 2015. A need for nationally consistent water use metrics has now been recognized by other interagency groups, including SWAQ, which reports to the Committee on Environment and Natural Resources for the National Science and Technology Council in the White House Office of Science and Technology Policy. Further, federal agencies will continue to promote programs that enable local entities to implement water efficiency and reuse/reclamation projects.

2014 HIGHLIGHTS OF PROGRESS

A summary of 2014 efforts from the Water Use Efficiency Team and an overview of activities being carried out by each agency in support of improvements in water efficiency are provided below. As demonstrated by the activities listed below, each agency has significant work underway. Some of the projects, the results of which would be critical to advancing activity on metrics, have timeframes that, by necessity, extend beyond the shorter timeframes referenced by the action plan. However, committing to ongoing coordination and collaboration to keep other agencies aware of these and other efforts will provide significant benefits towards advancing water use efficiency efforts to support respective stakeholders.

4.1. Improving Water Use Assessment in the Water Census Program: USGS is conducting the Water Census under the umbrella of the DOI WaterSMART Initiative. The project is wide-ranging and has subprojects that will build a foundation for development of metrics and better assessments of water use in different sectors. The website at http://water.usgs.gov/watercensus/ provides information about the Water Census and affiliated efforts. Of note, in 2014 the Census released a beta version of a Data Platform that will help integrate datasets needed to help states and localities develop water budgets. Subprojects which are part of the Census include:

- **Water Use in the United State.** USGS completed the report, *Estimated Use of Water in the United States in 2010*, which was released to the public in November 2014.

- **Public Supplies.** WaterSMART is working on a seven-year effort to develop a site-specific water use database for 55,000 public water systems that will be able to link with monthly withdrawal amounts by type of delivery (e.g., domestic, industrial, or cooling uses). After the database is completed, a consumption profile for each facility will be developed. This project is in coordination with EPA and the products should be released to the public in fiscal year 2017.

- **Irrigation.** WaterSMART is working on a large project looking at the amount of evapotranspiration (ET) associated with irrigated cropland in order to develop a better sense of the consumptive use associated with irrigation (i.e., how much of a crop can we produce per amount of water consumed). An article documenting the work was published in the *Journal of the American Water Resources Association*, available at:

http://onlinelibrary.wiley.com/doi/10.1111/jawr.12057/abstract. The project is being piloted in the Colorado River Basin, and the estimated ET from irrigated cropland will be released in 2015. This project is being coordinated with USDA NRCS and the Bureau of Reclamation, which is a large user of this information. USGS also has a project underway with Utah State University to look at methodologies for ET measurements. Many states have their own ET methods, and want to incorporate this into the Water Census.

- **Thermoelectric Power.** As part of follow-up to recommendations from a Government Accountability Office (GAO) report released in 2010, USGS has continued to work with the Energy Information Administration to improve the collection of water use data from thermoelectric power plants and better estimate consumptive water use associated with plants, rather than just withdrawals. The first report from this effort was published and distributed in November 2013. The report, entitled *Methods for Estimating Water Consumption for Thermoelectric Power Plants in the United States (*USGS Scientific Investigations Report 2013-5188), presents a model for estimating the consumptive use of water at thermoelectric power plants. The report may be accessed at: http://pubs.usgs.gov/sir/2013/5188/pdf/sir2013-5188.pdf. In September 2014, USGS released a companion report, *Withdrawal and Consumption of Water by Thermoelectric Power Plants in the United States, 2010* (USGS Scientific Investigations Report 2013-5184), which estimated water use for 1,290 water-using plants in the U.S. based on the methodology in the earlier report. This report may be accessed at http://pubs.usgs.gov/sir/2014/5184/.

4.2. Release of the Principles and Requirements for Water Resource Investments: CEQ released an update of the Principle, Requirements, and Guidelines for Water Resource Investments (formerly, Principles and Standards) in March 2013, making water use efficiency an explicit consideration in federal water resources investment decisions. The Interagency Guidelines document was released in December 2014. More information can be found at: http://www.whitehouse.gov/administration/eop/ceq/initiatives/PandG.

4.3. Assessing agricultural water use efficiency in the Ogallala Aquifer: As part of ongoing USDA efforts to evaluate agricultural conservation programs, the NRCS began an evaluation on the effectiveness of federal programs to reduce irrigation water withdrawals from the Ogallala Aquifer. The 2013 assessment phase of the evaluation found large reductions in water withdrawn and energy consumed from program implementation. Alternative program approaches are also being evaluated against program objectives and alternative effectiveness measures, including water use efficiency. In 2015, alternative program approaches will be evaluated against program objectives and alternative effectiveness measures, including water use efficiency.

4.4. Developing State Water Data Exchange: The Western States Federal Agency Support Team (WestFAST), in cooperation with the Western States Water Council (WSWC), is engaged in a major project to create an exchange that will enable states to share important water planning and use data, to inform support studies that cross state borders. More information can be found at: http://www.westernstateswater.org/wade/. One goal of the project is to be able to provide more comprehensive water withdrawal and consumptive use data; however, at this time, many states do not collect this information, and the methods used vary by state. To assess this variability, the WSWC issued a survey and compiled all of the state water planning agency responses in a summary report, the "Western State Water Program Capabilities Assessment Survey & Report," found at: http://www.westernstateswater.org/western-state-water-program-capabilities-assessment-report/. The report contains survey results that highlight the similarities and differences between states' water planning activities, such as data gathering, water use reporting, and data management. It also discusses the challenges regarding a regional water availability and use picture of the west and makes several recommendations to achieve that goal. WSWC is in the process of assisting a handful of pilot states to deploy the infrastructure necessary to participate in the exchange. By mid-2015, he Water Data Exchange (WaDE) portal is anticipated to be comprised of data from a majority of western states. The work will support both the Water Census and DOE studies looking at the availability of water for energy in the western U.S.

4.5. National Drought Resilience Partnership: In November 2013, as part of President Obama's Climate Action Plan, federal agencies established the National Drought Resilience Partnership (NDRP) to help communities better prepare for future droughts and reduce the impact of drought events on livelihoods and the economy. In response to requests from communities, businesses, and farmers and ranchers, the NDRP will make it easier to access federal drought resources. The NDRP will link information such as monitoring, forecasts, outlooks, and early warnings with longer-term drought resilience strategies in critical sectors such as agriculture, municipal water systems, energy, recreation, tourism and manufacturing. Of particular note, beginning in 2014, the NDRP, in partnership with the State of Montana, is pursuing a "proof of concept," around long-term drought resilience by demonstrating how improved drought planning and resilience could be achieved through enhanced coordination of federal agency resources in the Upper Missouri River Watershed in Montana.

4.6. Impacts of Changes in Water Availability on the Energy Sector: DOE is continuing to assess the challenges and opportunities of the energy-water nexus and the effects of decreasing water availability and climate change on energy systems. DOE is developing recommendations and pursuing activities to address knowledge, technology and policy gaps for building a secure and sustainable energy future, building upon the July 2013 report: "U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather."

This report is available at: http://www.energy.gov/downloads/us-energy-sector-vulnerabilities-climate-change-and-extreme-weather.

4.7. ***The Water-Energy Nexus: Challenge and Opportunities:*** In June 2014, DOE released this report, which takes a broad look at several different strategic areas including optimizing the freshwater efficiency of energy production, electricity generation, and end use systems as a means to lay a foundation for coordinating research and development between DOE and other federal partners. In addition, this report examines opportunities to optimize the energy efficiency of water management, treatment, distribution and end use systems. This report is available at: http://www.energy.gov/downloads/water-energy-nexus-challenges-and-opportunities.

In addition, Sandia National Laboratories, in collaboration with USGS, several states, and the WSWC, released a paper in May 2014 that describes their efforts to assess water use and demand in the western U.S. The work supports efforts funded by DOE's Office of Electricity Delivery and Energy Reliability to assess the nexus between energy and water in western states and Texas to support future decision-making on planning for future energy needs. The paper, *Mapping water availability, projected use and cost in the western United States* is available at: http://iopscience.iop.org/1748-9326/9/6/064009/article.

4.8. **Monitoring Studies of Water Use Metrics:** EPA is following two significant projects that are underway by the Water Research Foundation.

- A project to update and expand the Residential End Uses of Water Study from 1999 is expected to be complete in 2015.

- A project to develop and test methodologies to collect standardized data to determine the proportion of commercial, institutional, and industrial end uses of water. There is considerable inconsistency in how water utilities identify these types of facilities in their billing and water use records, which hinders forecasting and benchmarking. A final report is expected in 2015.

4.9. **Revising Water Efficiency Grants to Include Additional Water Savings Data**: The Bureau of Reclamation continues to review the process used to select water conservation grants and look at how grantees assess the different measurements of success for water savings. In 2012, significant revisions were made to the funding opportunity announcement for WaterSMART Grants to request more detailed support for applicants' water savings estimates so that those estimates could be evaluated as effectively as possible. The Bureau is also conducting before and after visits to project sites for a sample of funded projects to compare project sponsors' estimates of water savings with post-project results. The information gathered during this process may benefit to the work on metrics.

4.10. **Army Net Zero Installations**: Following their pilot program, in 2014 the Army issued a directive that extended the Net Zero policy to all Army installations. For water, the

Commands are asked to implement the Net Zero policy to the maximum extent practicable and fiscally prudent by reducing overall water use, regardless of source; increasing the use of technology that uses water more efficiently; recycling and reusing water, shifting from the use of potable water to non-potable sources as much as possible; and minimizing interbasin transfers of any type of water, potable or non-potable, so that a Net Zero water installation recharges as much water back into the aquifer as it withdraws. More information is available at: http://www.apd.army.mil/pdffiles/ad2014_02.pdf.

4.11. Implementing Net Zero Planner Program: The USACE Construction Engineering Research Lab is developing planning-scale tools to integrate Army installation actions that support net zero energy, water, and waste. The Net Zero Planner (NZP) tool includes multi-scale modeling and analyses of water conservation measures to document potential water and energy savings. During FY 2014 this research project developed models for individual water measures. These models calculate the integrated effect of the measures on water, energy and waste and allow optimized planning. In addition, the models are being captured in the NZP tool, which will be released by the end of FY 2015. Initial demonstration sites for the NZP include Fort Leonard Wood, MO; Fort Hood, TX; and RAF Lakenheath, England.

4.12. Refinement of a Mobile Tablet Water Equipment Tracker: The Office of the Assistant Secretary of the Army (Installations, Energy and Environment) funded the USACE Construction Engineering Research Lab to develop a mobile tablet Water Equipment Tracking (WET) application to be used to inventory and track water related equipment in individual facilities. A report describing the tool was published in late 2013 and is available at: http://acwc.sdp.sirsi.net/client/en_US/search/asset/1031240. The WET helps to eliminate transfer errors in auditing and provides an immediate estimate of building water consumption based on occupancy, use, and existing equipment. In FY 2014 additional funding was made available by the OASA (IE&E) to adjust the existing algorithms that were created to provide building level estimates of water demand. These revised algorithms were compared with meter data at Fort Campbell and Fort Leonard Wood for residential, barracks, dining facilities, and administrative building types. Further refinements of the algorithms are in progress to ensure reasonable estimates can be provided across all Army installations.

4.13. Expanding EPA's WaterSense Program: Efficient use of water is a key strategy for managing water resources as supplies become more unpredictable as a result of climate change. In 2014, the program finalized changes to its program for labeling professional certification programs and released draft specifications for commercial toilets. The program also carried out a focused campaign in 2014 with the hospitality sector to encourage them to use the *WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities*, as a means to track and reduce water use.

The WaterSense program continues to work with the EPA ENERGYSTAR program to evaluate data collected by Fannie Mae for multifamily housing to determine if the data is sufficient to support water benchmarking. In 2014, based on popular request, ENERGY STAR also added water use back as a recognition category for its National Building Competition. It was previously included in 2012 and excluded in 2013.

4.14. Maintaining WaterSMART Grants for Water Efficiency: The Bureau of Reclamation's WaterSMART Grants program offers cost-shared grants for water and energy efficiency. The grants cover water management improvements, including piping of channels to reduce seepage, installation of more advanced water management and irrigation devices, and municipal rebate programs for activities including metering and turf replacement. Approximately 194 projects have been funded since FY 2010. Projects funded under WaterSMART Grants and other water conservation programs FY 2010 through FY 2014 enabled the conservation of 860,000 acre-feet of water, exceeding DOI's Priority Goal of 790,000 acre-feet for that period. More information is available at: http://www.usbr.gov/WaterSMART/weeg/.

Table 5. 2015 WORKPLAN
Recommendation 4: Expand Water Use Efficiency

Task Number	Task	Projected Completion

1	Maintain interagency team working on water use efficiency.
	• Develop inventory of key federal programs that advance water efficiency.
	• Share and maintain information about water use efficiency data/programs/projects with various federal "toolbox" efforts (e.g., Federal Support Toolbox, Drought.gov, National Drought Mitigation Center, Climate Resilience Toolkit, and Open Water Data Initiative).
	  ○ Identify key repositories/toolboxes.
	  ○ Identify where certain types of data that could support metrics and other activities should be stored/shared (e.g., Open Water Data).
	  ○ Develop recommendations on how to strengthen coordination and adoption of "key practices."
	  ○ Develop a proposed process to provide input to (and regularly update) key efforts. [Supports CRWG Priority J].
		Ongoing

2	For a major water use sector (e.g., agriculture, energy, municipal), identify policy gaps (e.g., science, policy, technology) and other barriers that hinder the ability to collect data that would facilitate assessment of water use, efficiency, and development of metrics. • Develop an initial strategy that, while recognizing gaps, would help to describe how to identify consistent metrics in a major water use sector. This initial strategy could be used as a template to address other sectors. • Based on findings, develop recommendations for further efforts.	2014/ 2015
3	Support the National Drought Resilience Partnership initiative by providing input on potential water use efficiency efforts that can support resilience efforts in the Upper Missouri River Basin interagency drought planning and preparedness pilot.	2014/2015
4	Implement Principles, Requirements and Guidelines for federal water projects by having individual agencies publish final Agency-specific Procedures (within 180 days of published guidelines) [Supports CRWG Priority M].	Spring 2015
5	Continue work to revise the revise Draft NEPA Greenhouse Gas Guidance following the 2014 public comment period for the updated draft guidance for federal agencies on how to consider greenhouse gas emissions and the impacts of climate change in NEPA analyses; and release the final guidance on conducting programmatic NEPA reviews. See: http://www.whitehouse.gov/administration/eop/ceq/Press_Releases/December_18_2014.	Ongoing

Water-related priorities and recommendations derived from the Climate and Natural Resources Working Group (CNRWG) and the State, Local, and Tribal Leaders Task Force (SLTLTF) are described below as applicable to Recommendation 4 – Expand Water Use Efficiency.

Stakeholder Priorities and Recommendations		
J.	CNRWG Priority Related to Task 1	*The EPA WaterSense program will increase the efficient use of water so that the greenhouse gas reduction resulting from the reduced use of energy to move and heat water increase from 7 million metric tons of CO2 equivalent per year in 2011 to 23 million metric tons per year in 2018.*

K.	CNRWG Priorities Related to Task 2	*USDA will invest in efficient irrigation and management strategies to address groundwater depletion and improve drought.* *Bureau of Reclamation will continue to incorporate climate change considerations throughout its programs and policies, including implementing the WaterSMART Program to address near-term impacts of climate change via the competitive grants provided to non-federal partners; conducting the Basin Study to develop adaptation strategies to meet future water supply needs; and assisting study partners with the technical expertise, planning support, science, and tools needed to advance adaptation strategies that can be implemented by non-federal stakeholders.* *USDA will use Farm Bill programs to support conservation practices and technologies that build drought resilience. Through planned research, USDA will also enhance food security through analyzing improved crops and plant breeding tools with increased resilience to heat and drought; developing systems to model and test climate change scenarios' impact on animal, food, and waterborne diseases and pests; and by researching drought impacts to nutritional composition and quality of food.* *Bureau of Reclamation will launch its Water and Power Solutions Technology Challenges program.*
L.	CNRWG Priorities Related to Task 3	*The interagency National Integrated Drought Information System (NIDIS) will broaden its regional drought early-warning information capabilities in partnership with states, tribes, and communities.*
M.	CNRWG Priorities Related to Task 4	*In 2015, Agencies will develop agency specific procedures to implement the new PR&G and will lead an effort in 2015 to fully implement these modernized criteria for climate-resilient water resource investments.* *USACE will incorporate climate considerations into water reallocation strategies.*

Recommendation 5: Support Integrated Water Resources Management

Management of the risks from a changing climate should not occur in isolation and should be integrated with efforts to address other freshwater resources management challenges. As models and methods for integrated water resources management (IWRM) are developed across the country, challenges posed by a changing climate should be incorporated.

The IWRM team, led by USACE, managed the implementation of actions and tasks to support this recommendation. Four supporting actions were established for this effort. Several are completed and described below.

Recommendation 5 Actions

Supporting Action 17: Work with States and interstate bodies (e.g., River Basin Commissions) to incorporate IWRM into planning and programs, paying particular attention to climate change adaptation issue.
Supporting Action 18: Revise federal water project planning standards to address climate change. **(COMPLETE)**
Supporting Action 19: Working with States, review flood risk management and drought management planning to identify "best practices" to prepare for hydrologic extremes. **(COMPLETE)**
Supporting Action 20: Develop benchmarks for incorporating adaptive management into water project designs, operational procedures, and planning strategies. **(COMPLETE)**

2014 HIGHLIGHTS OF PROGRESS

Key accomplishments in 2014 related to Recommendation 5 include:

5.1. Adaptation Pilot Studies: The USACE funded several climate change adaptation pilot studies that address certain aspects of IWRM. Completed pilot reports may be found at: http://www.corpsclimate.us/rccpad.cfm. Additional studies are under consideration for FY16 and subject to existing agency priorities and commitments. FY14 highlights of the pilot studies are described below.

An IWRM climate adaptation pilot study for the **West Maui Watershed** encompassing the region from the summit of Pu`u Kukui to the outer coral reef was completed and a report

released at: https://corpsclimate.us/docs/WestMaui_ClimateChange_MainReport.pdf. The central question addressed by the pilot is: How can a risk-informed decision-making (RIDM) framework be incorporated at the beginning of a collaborative planning process for a place-based climate change adaptation strategy, and what are the challenges of implementing an IWRM framework? Partners in the pilot included USACE-Honolulu District, the State of Hawaii Department of Land and Natural Resources (DLNR) and the Department of Health (DOH) with support from NOAA and EPA. As part of the pilot study, a decision framework was developed to guide the West Maui Ridge to Reef (R2R) Initiative. The pilot identified several factors as being important in future similar efforts:

- A shared lexicon is critical in an interagency planning process.
- Decision making agencies must first have a clear understanding of the decision framework before engaging the broader stakeholder community.
- Climate change should be incorporated early in the early in the planning process.
- Interagency initiatives are most effective when they use or develop a framework suited to their particular objectives (i.e., there is no one-size-fits-all framework).

USACE continued to participate in an IWRM climate adaptation pilot for the **Los Angeles Basin Watershed** (Watershed) in collaboration the Los Angeles County Department of Public Works' (LACDPW) and the Bureau of Reclamation's Los Angeles Basin Stormwater Conservation Study (Basin Study). The effort covers the Los Angeles River Watershed and the San Gabriel River Watershed, with the objective to assess and manage future climate change impacts on freshwater resources in the Watershed. The FY15 scope is under consideration.

A third pilot study involving regional collaboration with the **Ohio River Basin** (ORB) Alliance made progress in FY14, and a report is expected in FY15. The Alliance includes representatives from federal agencies, states, non-governmental organizations (NGOs) and universities. The aim of the pilot study is to collaboratively develop mitigation and adaptation strategies with the ORB Alliance to counteract the anticipated water resources, ecological, and infrastructure impacts of climate change. One product of this pilot is the formation of a permanent climate change working group within the ORB Alliance to assist in future IWRM activities.

5.2. State Flood and Drought Risk Management: A contractor completed a review of State Hazard Mitigation Plans in 2012, published at: http://ascelibrary.org/doi/abs/10.1061/%28ASCE%29NH.1527-6996.0000063. A survey of State Hazard Mitigation Officials (SHMO) and State Floodplain Management Officials has also been completed. In total, 46 SHMOs and 45 NFIP Coordinators responded to the survey. A report documenting the survey results has also been completed.

5.3. Integrated Water Resources Science and Services (IWRSS): USACE, USGS, and NOAA's National Weather Service established IWRSS to enable and demonstrate a broad, integrative national water resources information system to serve as a reliable and authoritative means for adaptive water-related planning. The agencies continue to

implement IWRSS in the areas of improved data interoperability and flood inundation mapping.

Table 6. 2015 WORKPLAN
Recommendation 5: Support Integrated Water Resources Management

Task Number	Task	Projected Completion
1	The USACE will continue to work on adaptation pilot studies that address certain aspects of IWRM. 2015 goals include: • Complete Ohio River Basin study and Report; • Make progress on the Los Angeles Basin Watershed project; and • Consider additional studies.	Ongoing
2	Collaborate with water managers and working groups such as CCAWWG, WUCA, and TVA to identify characteristics of IWRM best practices. [Supports CNRWG Priority O].	Ongoing

Water-related priorities and recommendations derived from the Climate and Natural Resources Working Group (CNRWG) and the State, Local, and Tribal Leaders Task Force (SLTLTF) are described below as applicable to Recommendation 5 – Support Integrated Water Resources Management.

Stakeholder Priorities and Recommendations		
N.	State, Tribal Local Leaders Task Force Recommendation	*Support and incentivize water resource planning and management. Expand federal agency collaborations with State and local governments, Tribes, territories, and regional entities to evaluate the long-term risks of climate change on water resource availability and in the development of sustainable water resource plans and management strategies.*
O.	CNRWG Priority Related to Task 2	*Under DOI's leadership, federal agencies will work with partners to select and map flagship geographic regions for which they will identify priority areas for conservation, restoration, or other investments to build resilience in vulnerable regions, enhance carbon storage capacity, and support management needs.*

Recommendation 6: Support Training and Outreach to Build Response Capability

Today, the workforce that manages water resources programs at all levels of government and in the private sector needs information and tools to address the implications of a changing climate and/or to make complex climate change adaptation decisions related to freshwater resources. Implementation of actions and tasks in support of Recommendation 6 were addressed by the full Water Resources and Climate Change Workgroup rather than an individual team.

Throughout 2014, the Workgroup co-chairs, in conjunction with the agency members of the Workgroup, managed the implementation of actions and tasks to support this recommendation. Four supporting actions, listed below, were established for this effort.

Recommendation 6 Actions

Supporting Action 21: Establish a training program that will increase the ability of technical practitioners to incorporate climate change information in the studies they conduct that inform water and water-related resource management decisions.
Supporting Action 22: Focus existing youth outreach programs on climate change and water issues.
Supporting Action 23: Engage Water Resources Research Institutes at land grant colleges in climate change adaptation research. **(POSTPONED)**
Supporting Action 24: Increase graduate fellowships in water management and climate change. **(POSTPONED)**

2014 HIGHLIGHTS OF PROGRESS

Key accomplishments in 2014 related to Recommendation 6 include:

6.1. Developing Climate Change Training Capacity: The Bureau of Reclamation worked with other federal agencies, including USACE and EPA, and with the Western Water Assessment and UCAR to design and develop a technical training curriculum that instructs water resources professionals on how to incorporate climate science and its associated uncertainties into hydrologic assessment studies. This professional development series is titled: Assessing Natural Systems Impacts under Climate Change. More information is available at: http://courses.comet.ucar.edu/course/info.php?id=136.

In August, 2014, the program conducted a new course addressing Water Temperature Impacts under Climate Change. In this three day, instructor-led, in-classroom course, participants explored methods to scope, conduct, and document an assessment of impacts, considering uncertainty, from a changing climate on water temperature.

Other courses in the series include:

- Introduction to Climate Models (currently available; about 1.5 hours of material);
- Preparing Hydro-climate Inputs for Climate Change in Water Resource Planning (currently available; about 5 hours of material); and
- Basics of Water Temperature: Watershed Flyover (will be available in early summer 2015; about 40 minutes of material).

6.2. Carrying-Out Climate Ready Water Utilities Webinars: In 2014, EPA, in coordination with the Water Utility Climate Alliance, provided a series of six webinars. More than 400 participants learned about utility decision-making and planning methods as well as relevant tools and resources for the water sector. Through these 60-minute webinars, participants developed a greater understanding of how to plan for and adapt to challenges, including climate change and extreme events. Webinar topics included threshold analysis, financing adaptation and communicating climate risk. The webinars featured case studies from utilities that have used these decision-support methods to become more climate ready, including two utilities in Florida. The webinar sessions are archived on EPA's website at www.epa.gov/climatereadyutilities.

6.3. Webinars: Climate Information for Managing Risks in Water Resources: The NOAA Sectoral Applications Research Program (SARP) works with partners to provide a monthly series of webinars on climate change and water resources issues. Partners include NIDIS, the Water Research Foundation, WEF, WERF, and AWWA. Webinars conducted in 2014 are described below. More information is available at: http://cpo.noaa.gov/ClimatePrograms/ClimateandSocietalInteractions/SARPProgram/WebinarsandWorkshops.aspx.

Topics covered in 2014 include:

- **Decision Making into Local/Regional Planning (1/15/14)**
  Latham Stack (Syntectic International) and Michael Simpson (Antioch University – New England), et al. - "Stakeholder Driven Decision-Making for Adaptation: Design and Implementation of a Water Infrastructure Adaptation Plan."

  Vikram Mehta (Center for Research on the Changing Earth System) - "Interannual to Decadal Climate Variability Information for Risk Assessment, Urban Water Policy, and Decision Support: Case Studies of Kansas City, Lincoln, and Great Falls Urban Areas within the Missouri River Basin."

- **Working with Communities (2/21/14)**
  Dr. Heather Lazrus (National Center for Atmospheric Research) - "Water Decisions for Sustainability of the Arbuckle-Simpson Aquifer."

  Dr. Ken Potter (University of Wisconsin) - "Demonstration Storms for Identifying Climate Vulnerability."

- **The California Drought (3/24/14)**
  Jeanine Jones – "The California Drought and Related Climate Science Needs."

- **Stakeholder Communications (4/17/14)**
  Daniel Ferguson (University of Arizona) and Jennifer Rice (University of Georgia) – "Linking Environmental Research and Practice: Lessons from the Integration of Climate Science and Water Management in the Western United States."

  Karen Raucher (Stratus Consulting) – "Five Americas for Community Water and Climate Change: A Nationally Representative Segmentation Analysis."

- **Stakeholder Communications (5/22/14)**
  Paul Fleming (Seattle Public Utilities) and Aris Georgakakos (Georgia Institute of Technology) – "Findings from the 3rd National Climate Assessment: Implications for Water Utility Management, Planning and Decision Making."

- **Stakeholder Communications (12/3/14)**
  Mark Deutschman (Houston Engineering, Inc.) - "The Role of Climate and Water Resources Data in Societal Decisions."

6.4. ThinkWater Education Summit: ThinkWater is a national project sponsored by the USDA and designed by educators, scientists and activists in partnership with the University of Wisconsin Extension to add thinking skills and awareness into existing water education lessons. The modified lessons and their delivery will create Water Thinkers – people who care about and deeply understand water and the issues surrounding it.

In November, 2014, ThinkWater hosted a national water education summit in Madison Wisconsin. Participants from around the country gathered to diagnose and prescribe how to increase the impact of existing water education curriculum. Attendees include national, regional and local experts in water education, youth development, STEM, policy and program directors, educators, cognitive scientists and thought leaders, exploring the challenges and solutions surrounding water education. Videos and other resources are available at: www.waterthinkers.org.

Table 7. 2015 WORKPLAN
Recommendation 6: Support Training and Outreach to Build Response Capability

Task Number	Task	Projected Completion
1	EPA will continue to conduct webinars and training on CREAT and related water utility and climate issues.	Ongoing
2	EPA will establish an online training program on climate change and water issues for water program staff and the public as part of the Watershed Academy network of training courses.	Summer
3	NOAA will continue to conduct monthly webinars on water resources and climate change with partners.	Ongoing
4	Sponsored by CCAWWG agencies, UCAR COMET will: (A) Continue to develop and deliver courses in a pilot COMET Professional Development Series aimed at training technical practitioners on how to assess climate change impacts for a spectrum of natural resources. Planned activities: (1) Sedimentation Impacts under Climate Change, Feb. 2015 (2) Hydrology Impacts(virtual), second offering, June 2015 (3) Scoping of courses addressing assessment of climate change impacts on land cover, coastal resources, and potentially water quality. (B) Begin development of a companion pilot COMET Professional Development Series training aimed at training less technical staff that will play key roles in mainstreaming climate change considerations into water resources management missions, where it makes sense. Audiences include leadership, line managers, programs and project leads, resources specialists, etc. An initial online, self-paced, general purpose training resource in scoped for development in late 2015. (C) Continue to explore business model strategies for making these piloted training resources self-sustaining.	Ongoing
5	NOAA, USDA, and DOI, in cooperation with other federal agencies, will define a framework for education and training to build climate literacy and capability among relevant federal agency staff and technical service providers, such as planners, engineers, and consultants. The framework will include assessing climate literacy in federal agencies and developing	2015

	partnerships with nonprofit or professional groups to promote climate resilience outreach, education, training, certification, and engagement of academic training capability. [Supports CNRWG Priority P].	
6	In 2015 and subsequent years, the FWS National Conservation Training Center plans to train hundreds of natural resource managers across the country in climate smart conservation using the *Climate Smart Conservation Guide* that describes practices to safeguard vital natural resources in a changing climate. [Supports CNRWG Priority Q].	Ongoing
7	USDA will continue implementation of ThinkWater youth education.	Ongoing
8	EPA, in cooperation with the EPA Local Government Advisory Committee, will develop and post online a climate adaptation training program focused on the needs of local government, including consideration of climate change and water issues.	Spring
9	EPA will host a workshop on change vulnerability assessments for National Estuary Program managers. The agency will raise the capacity of key stakeholders to prepare for climate change by teaching about what risk-based climate change planning is and demonstrating how to create risk-based vulnerability assessments.	Spring
10	The National Park Service will complete the development of a Natural Resource Career Field Academy online climate change module to help resource professionals understand key climate change related issues and explore adaptation and planning options. [Supports CNRWG Priority R].	2015

Water-related priorities and recommendations derived from the Climate and Natural Resources Working Group (CNRWG) and the State, Local, and Tribal Leaders Task Force (SLTLTF) are described below as applicable to Recommendation 6 – Support Training and Outreach to Build Response Capacity.

Stakeholder Priorities and Recommendations		
P.	CNRWG Priorities Related to Task 5	*NOAA, USDA, and DOI, in cooperation with other federal agencies, will define a framework for education and training to build climate literacy and capability among relevant federal agency staff and technical service providers, such as planners, engineers, and consultants.*
Q.	CNRWG Priority Related to Task 6	*FWS will use their Climate Smart Conservation Guide to train hundreds of natural resource managers across the country in climate smart conservation.*
R.	CNRWG Priority Related to Task 10	*The National Park Service will complete development of a Natural Resource Career Field Academy online climate change module to help resource professionals understand key climate change related issues and explore adaptation and planning options.*

Membership List
Water Resources Workgroup of the
Climate Change Preparedness and Resilience Council

Co-chairs:

Council on Environmental Quality
- Chitra Kumar (2013/2014)
- Ellen Tarquinio (2014/2015)

U.S. Environmental Protection Agency
- Michael Shapiro

U.S. Geological Survey
- Jared Bales

Members:

Army Corps of Engineers
- Rachel Grandpre
- Rolf Olsen

Bureau of Reclamation
- Levi Brekke
- Dave Raff

Centers for Disease Control and Prevention
- Joan Brunkard

Council on Environmental Quality
- Susan Ruffo

Department of Agriculture
- Noel Gollehon

Department of Energy
- Craig Zamuda

Environmental Protection Agency
- Veronica Blette
- Karen Metchis
- Jeff Peterson
- Dwane Young

Forest Service
- Christopher Carlson
- David Levinson

Geological Survey
- Jerad Bales

National Aeronautics and Space Administration
- Bradley Doorn

National Oceanic and Atmospheric Administration
- Michael Brewer
- Nancy Beller-Simms

U.S. Army
- Marc Kodak

United States Department of Agriculture

National Institute of Food and Agriculture

US Army Corps of Engineers®

Prepared by the
Water Resources and Climate Change Adaptation Workgroup

Supporting the
Council on Climate Change Preparedness and Resilience

Adopted April 7, 2015