



US Army Corps
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BUILDING STRONG
COLLABORATIVE
RELATIONSHIPS FOR
A SUSTAINABLE
WATER RESOURCES
FUTURE

National Report:

Responding to National Water Resources Challenges





Approach to a More Sustainable Water Future

Integrated Water Resources Management (IWRM)

Governance and Management

Future National Water Resources Direction

Collaboration

Water Resources Investment Strategies

Managing Extreme Events

Technology Transfer and Knowledge Capacity Building

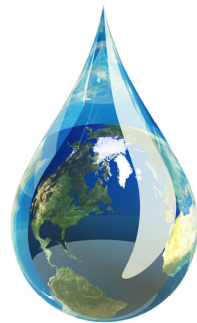
Enhance Water Resources Leadership

Communications and Education

*Building Strong Collaborative Relationships for a
Sustainable Water Resources Future*

National Report

Responding to National Water Resources Challenges



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Washington, DC 20314-1000

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The findings contained in this report are based on the information collected from the assessments, interviews and the regional and national conferences for this initiative and should not be construed as an official Department of the Army position, policy or decision unless so designated by other official documentation.



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Foreword

As important as water is to life, livelihood, and leisure, water is a resource that is often taken for granted until too much of it appears or too little is available to satisfy basic societal needs.

Managing water resources as a collaborative endeavor is becoming increasingly crucial as society faces demographic, economic, institutional and climate changes manifesting across the U.S. and around the globe. These changes portend a different understanding of the risks associated with the occurrence, location, intensity and impacts of extreme events—including floods and droughts.

Such changes will inevitably aggravate the competition for water in already stressed regions or emanating from population shifts to arid and semi-arid regions, and along our lakes, rivers and coastlines. Change will also affect water quality by stimulating sea level variations and, from different patterns in the movement of sediments, lead to intrusion of chemicals, other contaminants, and invasive species into water bodies and related land resources. Such change will accelerate the loss of wetlands and sensitive habitats, threaten species and reduce ecosystem services.

The resulting challenges facing the Federal government, the states, and interstate and local governments in our management—our collective stewardship—of public water resources come into focus as a shared responsibility for which collaboration is an imperative, not an elective choice.

Water resource planning to address these contemporary needs involves envisioning, formulating and assessing solutions against a backdrop of complex, but sometimes limited, scientific information which is not always completely understood. Planning processes are often seen as fragmented and expensive, while at the same time challenged to accommodate diverse stakeholder perspectives without being tinged with political realities. Although such planning is typically iterative by nature, its efforts are all too often limited in perspective and scope, stymied by constrained funding, and subsumed by higher priorities.

More deliberate, comprehensive planning is needed—intergovernmental by design—and founded on an appreciation of the interconnectivity among and between natural systems and human activities. More collaborative planning, both transparent and inclusive, embracing the systems perspective of watersheds, river basins, estuaries and coastal reaches is needed to realize the promise of concerted integrated water resources management.

The water challenges facing the Nation are compelling and the needs are great. Resolving water issues successfully will take time, funding and commitment by decision makers and stakeholders at all levels of government. To succeed we must act with a sense of urgency to improve the management of critical water resources—especially in an era where the variety of changes threatens the sustainability of all natural resources. The time to act is now.

This initiative represents a dialogue exploring the perspectives of the states, interstate, and stakeholder perspectives on water resources planning and challenges throughout the Nation. The U.S. Army Corps of Engineers was motivated to further this dialogue because we seek to continue to move our own Civil Works program towards a paradigm based on collaboration, sustainability and the embrace of

integrated water resources management—and we have concluded that success cannot be achieved alone—a sustainable water resources future can only be realized through a true intergovernmental partnership.

One desired outcome almost universally expressed by participants in this dialogue is to better articulate the roles and align the objectives across disparate water agencies, stakeholders, interests, sectors and all levels of government; however, with full recognition of the primacy of state water rights and responsibilities.

This report represents only the first phase of a journey ultimately aimed at improving water management through more effective collaboration between state, interstate and Federal water resources agencies. The document attempts to summarize the input from the diverse range of Federal, state, interstate, tribal, and nongovernment representatives who gave of their time and energy to join together and lay the groundwork towards a sustainable water future. It provides a synthesis of the issues and themes voiced during the dialogue, along with some general recommendations and suggested actions (next steps) for advancing integrated water resources management (IWRM).



Steven L. Stockton, P.E.
Director of Civil Works
Headquarters, U.S. Army Corps of Engineers

Executive Summary



ES.1 Purpose

The U.S. Congress, Administration, Federal agencies, states and local governments have played a central role in the Nation's public water management from the development of this Nation to times of crisis management. They have shepherded precious resources for the good of the Nation. They came together for this assessment to continue moving the Nation toward a shared vision of providing citizens responsible, effective and sustainable water resources planning and management.

The U.S. Army Corps of Engineers (hereafter the Corps) engaged in an objective assessment of states' water planning in 2008 and 2009 to identify common nationwide water resources needs. The *Building Strong Collaborative Relationships for a Sustainable Water Resources Future* (hereafter *Collaborating for a Sustainable Water Future*) initiative builds on a series of *Listening Sessions* the Corps conducted around the Nation between June 2000 and January 2001 to glean the major water resources challenges facing the United States. It follows on other assessments that described critical water resources needs, including the 1999 report by the National Academies' National Research Council, *New Strategies for America's Watersheds*; National Research Council reports; a series of Water Policy Dialogues sponsored by the American Water Resources Association between 2002 and 2008; and the 2006 and 2008 reports by the Western Governors' Association (e.g., *Water Needs and Strategies for a Sustainable Future: Next Steps*, 2008).





The first phase aimed to achieve the below objectives which were set forth to drive the direction of this initiative prior to initiation of the assessment:

- Identify key water resources challenges, needs and critical priorities among the 50 states
- Identify the major programmatic water resources activities within the Federal government agencies and opportunities for collaboration
- Build support among the Federal water resource agencies, interstate organizations/river basin commissions, states, tribal governments and nongovernment organizations (NGOs) in support of integrated water resources management
- Improve dialogue about key challenges and strategies to meet them
- Gain support for a common data portal that accesses a *Federal Support Toolbox* of information deemed useful in helping states and water agencies in their water resources planning

This report conveys an interpretation of what participating Federal, tribal, state, interstate and NGO representatives expressed during the course of this effort.

The Corps led the *Collaborating for a Sustainable Water Future* initiative as a facilitator, coordinator, integrator and convener. This report provides general recommendations and suggested actions based on the objective review of states' and Federal agencies' water planning and management documents, interviews with selected state and Federal water officials, and discussions at three regional conferences (Eastern Region in Orlando, Florida, in February 2009; Western Region in Kansas City, Kansas, in April 2009; and Central Region in St. Louis, Missouri, in June 2009). The discussion offered in this report also highlights insights that were proffered by Administration, Federal, and Congressional officials and attendees representing states, interstate organizations, tribes and NGOs at a National Collaborative Water Resources Conference held in Washington, D.C., in August 2009. Summaries of state water resources planning activities and interviews with key state water resource agency personnel, regional *Trends Reports, Conference Proceedings*, fact sheets, a *Federal Agency Assessment* report and PowerPoint briefings were developed to catalog research findings and discussion; some of these documents are posted on a website (www.building-collaboration-for-water.org). When final, additional reports and documents will be posted on this website.

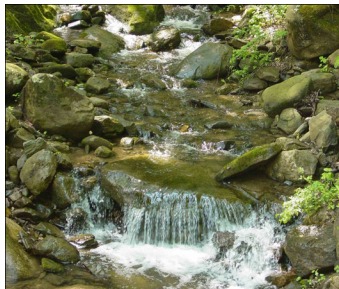


ES.2 Themes

Based upon data, information and participant input obtained during the course of this initiative, nine major overarching water resources themes emerged as areas deserving action to facilitate more collaborative and effective management of our Nation's water resources. These themes and primary recommendations are identified below:



- 1. Integrated Water Resources Management (IWRM)**
Make integrated water resources management more understandable and a preferred way to plan and manage public water and related land resources as a system.
- 2. Governance and Management**
Strive to revitalize and/or reshape means at all levels of government to improve water resources management, decision making and evaluation in ways that build the public will to act for integrated water resources planning and management.
- 3. Future National Water Resources Direction**
Foster continued dialogue about a sustainable national water resources future direction and develop supporting strategies to elevate water resources and related infrastructure as a critical national priority.
- 4. Collaboration**
Promote opportunities and mechanisms for collaborative water resources planning and management.
- 5. Water Resources Investment Strategies**
Promote and develop innovative and sustainable financing mechanisms for public water resources solutions, including water infrastructure, at Federal and state levels.
- 6. Managing Extreme Events**
Increase the ability to anticipate risks and manage emergency and evolving natural or man-made disasters, especially as related to water resources.
- 7. Technology Transfer and Knowledge Capacity Building**
Base the development of water resources plans and decision making upon good science and the sharing of information and technology. Increase scientific and management knowledge and technology/ technological capabilities at all levels of government.
- 8. Enhance Water Resources Leadership**
Build and reinforce leadership and stewardship for responsible water resources management among water professionals across Federal, tribal, interstate and state agencies, and at large.



9. Communications and Education

Enhance the ability of public officials at all levels and public and private water resources stakeholders to understand and communicate priorities for water resources through awareness-building, formal and informal education, learning initiatives, public outreach and communications activities.

For each theme, recommendations and suggested actions that could be taken to advance water resources planning and management are presented in Section 4 of this report.

ES.3 Findings and Conclusions

The two-year assessment of national water resources needs and critical priorities based on state input and regional summaries indicated that there are common drivers for water resources planning throughout the U.S. These drivers include addressing the challenges posed by an aging infrastructure; population growth causing rising water demand; environmental pollution from nutrients and chemical runoff from farms, sewers, roads, and sidewalks; competing uses for water; weather extremes from droughts to floods that create situations of too little or too much water to manage and degraded water quality.

To address these drivers, states seek support for funding from the Federal government to implement plans based on comprehensive statewide planning at a watershed scale; more reliable, complete and accessible data and information, including GIS-based and risk-informed maps; technical assistance for system-oriented water; and related resources planning and assistance in balancing needs through integrated water resources management. The states also expressed the need for support to enhanced maintenance and repair of aging infrastructure and for new stormwater, wastewater, and water supply facilities to provide reliable water related services.

The findings further showed that the water resources needs of the states are diverse and idiosyncratic given geographic, cultural, and historical characteristics that distinguish states and regions. However, the findings also presented commonalities that hold across states within a region and often across regions for a national perspective. States share key factors that influence their water resources planning: Federal regulations and policies, political and budget realities, the need for data and research, state tribal water rights issues, infrastructure funding, and a tendency to avail consensus-based processes and coordination to achieve their aims.

Critical water resources needs and critical priorities were assessed

regionally and nationally. The common needs assessed regionally and nationally include but are not limited to:

- Funding support.
- Sharing of data and information.
- Addressing an aging infrastructure.
- Support to reinforce Integrated Water Resource Management.
- Technical assistance.
- Demand for water quality and water supply.
- Balancing competing demands.
- Resolution of water rights.
- Addressing policy, authority, legislation and regulatory needs including governance fragmentation.
- Promote collaboration, coordination and communication among water resources stakeholders.



Resource constraints, a common critical need expressed by states and water resources agencies, may be the greatest handicap to moving forward toward a sustainable water resources future, although shortages provide the impetus for pooling resources through partnerships. The funding situation is complex and complicated by legal mandates, authorities, precedents and political realities. Mechanisms must be found to fund research, data collection, tools and analysis, information sharing, professional meetings, monitoring and protection of resources.

The Federal government and states have a wealth of information and insight to share. Sharing data and information ranked high in the states' needs assessment; therefore, the means must be found to enable mutual sharing and learning. The states certainly have increased their water resources competency and are able to develop statewide water plans based on comprehensive and rigorous data collection and analysis. Nonetheless, states call for Federal assistance to advance their planning at local, regional and statewide levels (i.e., to implement their state water plans). They desire information and models, particularly to help set priorities for investments, and they want to participate more fully in Federal priority-setting to guide future water and economic development.

Integrated water resources management (IWRM) is an ideal toward which to strive in order to manage multiple stakeholders intent on multiple water uses through multiple objectives for more balanced benefits. Robust concepts and models for IWRM hold the promise to manage the true complexity and interdependencies



that exist for water managed at a watershed scale. Integration can bring economy of effort and save resources to enable government at all levels to do more with fewer resources. IWRM is one of the needs identified through this process to achieve holistic solutions. Sustainability will require clear policies, roles, responsibilities, definitions, examples and feedback. The Federal government can provide technical assistance to help states develop comprehensive and integrated plans at local, regional and statewide levels based on available programs.

A Federal Support Toolbox of Federal authorities, programs, technical tools, and scientific and management information would facilitate Federal agencies to support water planning across the Nation. There are opportunities to begin collaborating: the need for a national water resources direction to include a water resources vision and unified principles and policies requires continued discussion; governance issues must be addressed to clarify roles and responsibilities and to promote integration instead of fragmentation; data and information must be probed and shared for better planning; implications of risk must be effectively communicated and built into decision models; and vehicles to share information across levels of government must be developed.

The Federal government, tribes, states, interstate organizations and nongovernment organizations have important roles in the stewardship of our Nation's water resources, which can be made even more effective through collaboration. Appropriate roles and responsibilities for water planning and management can be more clearly defined in the context of the national interest. The Federal government has a legitimate role to ensure consistency and equity across groups, especially to protect the disadvantaged, and to conduct assessments for economic and environmental needs.

To foster IWRM, an appropriate role for the Federal government may be that of integrator. Many participants in this initiative extolled the supporting role of the interstate organizations as vanguards in furthering integrated approaches and outcomes. The fragmentation of governance mechanisms at all government levels hinders government ability to support states' water resources planning and integrated water resources management in collaborative ways.

The Corps will continue to be a facilitator to advance the collaborative dialogue about the Nation's water challenges and the means to address them. The ideas and recommendations gained from this assessment will be presented to decision makers. The Corps desires to continue the dialogue with a national team of strategic allies joined by shared goals for the protection and enhancement of Nation's water resources.

Introduction



1.1 Objectives

Building and sustaining a healthy environment, vital economy, high quality of life and secure homeland require good planning and management of natural, fiscal, physical, social, human and intellectual resources. Water resources management is integral to these objectives. States face growing challenges at multiple and interrelated scales for many water resources objectives with diverse stakeholders. Understanding states' water resources needs and finding ways to align water resources objectives from state to Federal levels, and with tribes and public and private entities, can go far to address human and natural needs in today's constrained fiscal environment.

Many entities have contributed to the development of water resources in the Nation for over two hundred years. Participants from the U.S. Congress, the Administration, Federal resource management agencies, interstate organizations, and state and local governments that have served critical roles in developing America's public resources joined their perspectives with representatives from Tribes and the private and non-profit sectors through this assessment to be able to join forces for improved water resources management today and into the future.

The focus of this initiative is building synergy collaboratively to address water needs. Upon taking office, President Barack Obama issued a *Memorandum for the Heads of Executive*





*Departments and Agencies for Transparency and Open Government to promote public trust through transparency, public participation, and collaboration in the spirit of having openness strengthen our democracy and promote efficiency and effectiveness in government.*¹ The principle that *government should be collaborative* encourages Executive departments and agencies to “use innovative tools, methods, and systems to cooperate among themselves, across all levels of Government, and with nonprofit organizations, businesses, and individuals in the private sector.” A follow-on *Open Government Directive* from the Office of Management and Budget (December 2009) set deadlines for government departments and agencies to publish government information online, improve the quality of government information, and create a policy framework for a culture of open government. The Council on Environmental Quality issued the *Open Government Plan* to promote open government through environmental leadership, outreach and public engagement. The Corps initiated and has continued the *Collaborating for a Sustainable Water Future* initiative in the spirit of this Memorandum to share information and build trusting and collaborative relationships among water resources stakeholders and to meet the additional objectives listed below, which were established to focus the regional and national conference aims and discussions:

1. Raise awareness within the Administration of water resources challenges and opportunities.
2. Present critical national and regional water resources needs in the Western, Central and Eastern regions of the U.S. as identified by state officials and through research.
3. Present opportunities for improving the efficiency and effectiveness of Federal water programs and highlight examples of Federal agencies supporting integrated water resources management in collaboration with states.²
4. Identify and recommend strategies and actions for addressing high-priority state and regional water resources needs that can be supported by state and Federal water management agencies now.

¹The Memorandum can be found at http://www.whitehouse.gov/omb/assets/memoranda_fy2009/m09-12.pdf

²Integrated water resources management was defined by participants in this project as a way to develop and manage water, land and related resources, while considering the multiple viewpoints of how water should be managed (planned, designed and constructed, managed, evaluated and regulated). It is a goal-directed process for influencing the development and use of river, lake, ocean, wetland and other water assets in ways that integrate and balance stakeholder interests, objectives and desired outcomes across levels of governance and water sectors for the sustainable use of the earth’s resources.

5. Move the Nation toward integrated water resources management.
6. Assess the need for a national water resources vision.
7. Highlight tools that are in, or could be included in, a *Federal Support Toolbox* to assist states in their water resources planning and management.

The Corps future direction is to build a sustainable water future through integrated water resource management and collaboration. In this regard, in January 2010 the Corps issued an Engineering Circular (EC 1105-2-411) that provides guidance for conducting watershed planning and preparing Corps-led watershed plans (authorized under Section 729, Water Resources Development Act-1986, as amended), which will further move the organization and the Nation toward IWRM.

As Mr. Steven L. Stockton, Director of Civil Works for the U.S. Army Corps of Engineers and leader for this water resources initiative, stated: ***“This project is not about the Corps of Engineers taking over planning responsibility from the states. It is about facilitating all interests to work together to solve common problems and to share responsibility.”*** A national initiative is needed. Water planning may be more successful if local objectives and initiatives are developed through an integrated water resources management framework or a regional watershed perspective within the context of a shared direction for water sustainability that permits government at all levels to integrate needs, stakeholder interests, policies and programs, and scalable information on many levels, especially at the local level where implementation makes the difference.

The Corps managed this initiative with the purpose of engaging the Nation in substantive conversations about a new way forward for water management. Success will be the continuation of an ongoing dialogue toward actions that sustain, protect, and restore the economic and environmental lifeblood and vitality of the United States to thrive in the future. It will be up to those beyond the Corps to sustain dialogue about specific actions, to take action based on the findings of this study and to engage in further collaborations. The Corps intends to remain a facilitator to convene meetings for discussions about the themes generated by this assessment and to seize smart opportunities to act in concert with the themes and objectives of this initiative.



AWRA RECOMMENDATIONS

The Third National Water Resources Policy Dialogue (January 2007) urged government leaders to take action:

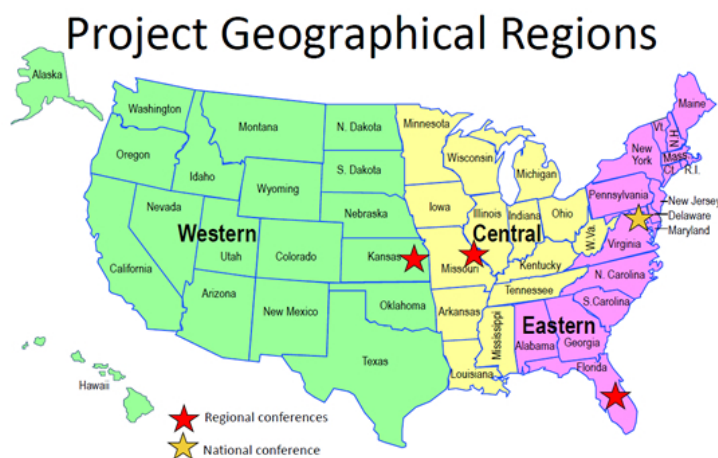
- Complete an up-to-date assessment of the Nation’s water resources challenges. The last assessment was 30 years ago.
- Establish a national water policy vision that translates into water policies with clearly defined roles and responsibilities for the government and the public.
- Reconcile contradictory water policies through better coordination among Federal agencies and across all levels of government.
- Encourage policies that promote watershed planning and change those that do not.
- Make available good science upon which to base water resource policy decisions.

1.2 Purpose of Report

This report presents a review of the assessment findings in general terms to engage senior government leaders, at a minimum, to develop a way forward for the Federal family to respond to water resources needs identified by a range of stakeholders, especially states. It contains policy and management recommendations for the Corps and other Federal agencies to achieve the objectives of this initiative.

This report is not a complete technical summary of the assessment conducted during the first phase, rather it is intended to summarize key findings and conclusions collected through the course of the initiative. It is a document proposing ways and

Figure 1



mechanisms for policy decision to approach integrated water resources management in a more collaborative way. In addition, an assessment of the programs of Federal resource and emergency management agencies was conducted to summarize their programs, capabilities, and activities as related to water resources. Water resources needs identified through the assessment will be matched to Federal programs and capabilities where possible to support the states. Individual *Trends Reports* and *Conference Proceedings* exist for the Western, Central and Eastern regions of the U.S. that present the water challenges, needs of the states, and opportunities for the inter-state organizations and Federal government to support the states in their water planning. These reports also reflect an



objective review of states' and Federal agencies' water planning and management documents, interviews with selected state and Federal water officials and discussions at three regional conferences (see Figure 1, Project Geographical Regions). Regional and national conference discussions allowed Administration, Federal and Congressional officials and attendees representing states, interstate organizations, tribes and NGOs to offer their opinions of the findings and to clarify what is within their purview to act on now. The findings are more descriptive than prescriptive. Prescribing the *what* and *how* of specific recommendations and proposed changes requires further study and discussion to determine details of how proposed changes may be implemented. Detailed recommendations and actions are the domain of an *Implementation Plan*, which is to be developed during the second phase of this initiative with specific data from the *Trends Reports* (3 reports), *Conference Proceedings* (4 reports), and other available information that will be collected and integrated to achieve the objectives set forth for this initiative.

The processes used in this initiative focused on information gathering rather than on consensus building. Thus, this report identifies the recurrent themes that surfaced across the states through interviews and in regional and national conference discussions and also makes general policy and programmatic recommendations based on the collective participants' inputs.

1.3 Background

Proactive water resource planning requires an efficient and effective mechanism to join perspectives and resources together. Integrated water resources management is not a new concept; it has been proposed and practiced before. Constrained resources and the imperative to collaborate have brought the wisdom of integration back into focus.

The historic report by the Secretary of Treasury, Albert Gallatin on "Roads, Canals, Harbors and Rivers" was presented to Congress on April 4, 1808. It defined the concept of internal improvement which in broad terms has remained up to modern times as a virtual statement of national policy. Some two hundred 308 River Basin planning reports were accomplished by the Corps in response to Section 308 of the River and Harbor Act of 1927 (January 21, 1927). Several of the 308 Reports laid

AWRA RECOMMENDATIONS

The Fourth National Water Resources Policy Dialogue held in September 2008 with a more limited but focused group recommended that the incoming Administration and the 111th Congress do the following:

- Update an assessment of the Nation's current state of water resources.
- Create a sustainable framework grounded in a national vision, guiding principles, and watershed context for water resources planning and management.
- Promote active partnering to guide Federal water resources development.
- Achieve better coordination among Federal agencies and Congressional committees.
- Reevaluate the Federal government's role in water resources planning and management in concert with states.



the groundwork for New Deal Planning.³ Under the 308 authority, Congress authorized studies at hundreds of watersheds across the U.S. that represented the first comprehensive river basin plans for the Nation. Gilbert White was a major influence in integrated water resources planning. His 225-page PhD thesis, entitled *Human Adjustment to Floods* from the University of Chicago's Department of Geography (Research Papers, No. 29, 1945, published in limited edition in 1942) led the intellectual development of water resources planning in the U.S. for a number of years, including *A Unified National Program for Managing Flood Losses: Report by the Task Force on Federal Flood Control Policy* (Washington, DC: Bureau of the Budget, 1966).

In July 1965, the Water Resources Planning Act (42 U.S. C. 1962-b2) established the Water Resources Council to coordinate, centralize and integrate Federal water resource planning and policy making.^{4,5}

The Corps assessment of states' water planning in 2008 and 2009 strived to identify common needs and opportunities for enhanced collaboration with states, including interstate organizations, Federal resource agencies, tribes and nongovernmental entities to leverage joint resources to improve water planning. The effort builds upon a series of *Listening Sessions* the Corps conducted around the Nation between June 2000 and January 2001 to glean the major water resources challenges facing the United States. It also follows other assessments that described critical water resources needs, including the National Academies' National Research Council 1999 report, *New Strategies for America's Watersheds* and their 2002 *216 Studies* on the Corps' water resource project planning process⁶; a series of Water Policy Dialogues sponsored by the American Water Resources Association between 2002 and 2008; and the 2006 and 2008 reports by the Western Governors' Association (e.g., *Water Needs and Strategies for a Sustainable Future: Next Steps*, 2008).

³Also see *House Document No. 456*, 89th Congress, Second Session.

⁴The 1965 Water Resources Planning Act established the Water Resources Council as an integrating mechanism for wise water resources management and the Principles and Standards to facilitate interagency planning. A 1973 National Water Commission expressed concern about the lack of national water policy, however, and recommended multiobjective planning and management through a river basin approach. The 1981 report to the Water Resource Council, *Impediments for Development of Water Resource Projects*, agreed that a lack of a national water resource policy was a major impediment and recommended establishing such a policy.

⁵See *New Directions in Water Resources Planning for the U.S. Army Corps of Engineers* by National Research Council, Committee to Assess the U.S. Army Corps of Engineers Water Resources Project Planning Procedures.

⁶See http://www.nap.edu/openbook.php?record_id=11444&page=12

Today, more than ever, there is an appreciation for collaborative planning. Participants of this initiative strongly extolled the virtues of an approach focused on a watershed, river system or river basin as a system called *integrated water resources management* (IWRM) for comprehensive statewide planning.⁷

1.4 Methodology

The assessment of the state of water resources planning throughout the U.S. was performed by the Corps team, which included a contractor, CDM. This assessment involves two phases: Phase 1, *Assessment—Data gathering*, nationwide discussions about water resources needs and critical priorities and reporting. Phase 2, will define the *Implementation* of the recommendations and actions gathered during Phase 1. The report herein represents the results of Phase 1.

The methodology used for Phase 1 was largely a qualitative assessment that consisted of gathering, analyzing, synthesizing, and summarizing information obtained through review of existing documents about water resources, especially state water plans and supporting documents, and interviews with state water resources officials and other water resources stakeholders. It also included basic research about trends affecting water resources planning and management, validation and additional data gathering through three regional conferences and a National Conference with representatives from Federal agencies, tribes, states, interstate organizations, nongovernment organizations and other interested personnel. The qualitative research involved collecting a plethora of information, looking for commonalities, and synthesizing disparate information into key themes and conclusions. In this vein, state information was summarized into regional findings, a comparison across the three geographical regions, and then some national conclusions.

The assessment was initiated with a review of state water planning and management documents using a standardized data-gathering protocol to produce a summary of each state's water planning and management activities, including: the status of water resources planning, responsible entities, water resources



⁷The Global World Partnership among the World Bank, the United Nations Development Programme, the Swedish International Development Agency, and entities involved in water management, who share a commitment to the principles of sustainability for a water-secure world, defined IWRM as a process that promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of ecosystems. See <http://www.unep.org/gc/gcss-viii/IWRMFF.OECD.doc>



vision and goals, scope of water resources planning and management, water needs, critical priorities and hotspots (geographic areas of critical needs), the nature and extent of collaborative water resources activities, implementation of state water plans, and outcomes achieved.

Summaries of water management activities were also developed for selected interstate/river basin commissions. Published information was augmented and validated through one-hour telephonic interviews with selected officials from states and river basin commissions using a common interview guide. Of interest was whether or not the state (or region) has a comprehensive water resources plan and if it is pursuing an integrated water resources management approach. Those who engaged in the interviews were requested to review and validate the resulting water plan summaries.

Simultaneously with the analysis of state water documents and interviews, research was conducted to glean issues and trends affecting water resources planning and management throughout the Nation today and into the future. Three *Trends Reports* for the Western, Central, and Eastern regions of the U.S. were produced based on the collected data and information. Participants of this initiative reviewed these reports.

Three Regional conferences were planned and conducted, one each in the West (Kansas City, Kansas), Central (St. Louis, Missouri), and East (Orlando, Florida) regions to present regional findings to stakeholders. The workshop format was designed to (1) garner additional information about states' water resources challenges and needs, ongoing activities, and lessons learned, (2) brainstorm recommendations, and (3) provide an opportunity for information sharing and collaboration. At each workshop, there were three small breakout group sessions to facilitate discussions. Participants in the three small breakout sessions addressed the following questions:

1. What are your most critical water resources needs and challenges? For each, please identify key drivers/influences affecting your critical water resources needs and challenges.
2. What strategies are you currently using to address these needs/challenges? What additional strategies/tools do you need to address these needs/challenges?
3. What is your best example of a successful collaboration initiative/activity? Where do you see additional opportunities for successful collaboration/partnerships? What should

be the roles of the Federal government, state government, and others (tribes, tribal councils, NGOs, commissions/councils, general public, etc.) in water resources planning and management?

The summarized output of each conference was presented in a *Proceedings Report* that captured highlights of small group discussions and plenary sessions to produce an overview of each region's sentiments about opportunities for more collaborative water resources planning and management.

A National Conference was also conducted with a diverse group of Federal agency and Administration personnel, state, tribal, interstate, and nongovernmental participants to present the findings of each region regarding the state of water resources management, common challenges facing states within each region, and the needs and recommendations for improved water resources planning and management. The National Conference provided the opportunity to hear feedback from Federal agency senior leaders about the findings and recommendations to enhance the conclusions of the assessment. This National Report (*Responding to National Water Resources Challenges*) encapsulates recommendations based on all the data collected from the Trends Reports, Regional Conference Proceedings and National Conference Proceedings.

Concurrently with steps to summarize states' water resources planning and management activities, the team generated a report summarizing the water and related resources responsibilities and activities of Federal agencies, the *Federal Agency Assessment*, which will be used to match the needs identified by the states with capabilities of Federal programs and initiatives in order to support implementation of the recommendations presented in this report.

Furthermore, each participant had opportunities to provide comments on the National Report. Comments received were assessed for inclusion into this final report. This National Report is not a complete technical summary of the assessment; rather it proposes ways for policy decision makers to approach integrated water resources management in a more collaborative way through realistic means and mechanisms. Instead of being an encapsulated summary of findings and conclusions, the National Report is part of a series of reports (regional trends analyses as context; state water resources planning summaries; a summary of Federal resource management programs and capabilities; regional conference proceedings of regional water resources planning processes, challenges, needs, and





recommendations as justification for national recommendations), and a summary of a national set of recommendations that collectively serve to describe how states approach their water planning and how they can better approach it in collaboration with others.

Phase 2 of the assessment will engage a collaborative implementation team to develop and carry out an *Implementation Plan* which will embrace the recommendations and actions of this report to move the Nation further toward a sustainable water resources future.



Water Resources Drivers



Trite but true: the only constant is change. National attention to water resources is spurred by common social, technological, economic, environmental, political and security drivers of change. These drivers may be legislation, population growth, population migration to coasts, assessments of the gap between available water supply and projected demand, the search for renewable energy sources, conservation, natural disasters, competing water uses, environmental changes (e.g., shrinking groundwater supplies, saltwater intrusion, point and nonpoint source pollution), and infrastructure breakdowns or insufficiencies given changing demands. A brief review of some of these drivers illustrates what influences states in their water planning.

SOCIAL drivers include population growth and migration, values, social networking and communication strategies, socio-economic and educational factors. Population has grown by 40 percent over the past 30 years. While the world population is expected to increase 2.2 billion by 2025, the U.S. population is projected to reach 440 million by 2050. The suburban population is growing faster than the central city population. Infrastructure is breaking down in city centers or is lacking in suburbs and exurbs. A more urbanized population is concentrated in high-risk coastal communities subject to severe storms and a lack of fresh water. Nine hundred million people worldwide lack access to clean water, and 2.5 billion people lack adequate sanitation. Water becomes a means to build stable nations and to promote trans-boundary cooperation.

SOME SOCIAL CONCERNS OF SELECTED STATES

Between July 2000 and July 2001, the net U.S. population grew by 2.7 million people, more than half moving to California, Texas, New York, Illinois and Florida, while population declined in Louisiana, Iowa, North Dakota and West Virginia.

Population is expected to grow another 25 million people by 2060 and by one million people in Oregon by 2030.

The regional population of Chicago, Illinois, is expected to increase 30 percent by 2040.

Population growth and development and global warming are of utmost concern in Florida.

Water use grew 50 percent faster than population growth in Minnesota between 1995 and 2005.



INVESTMENT NEEDS OF SELECTED STATES

WEST VIRGINIA and KENTUCKY suffer from a lack of distribution pipelines.

The MISSOURI RIVER states highlight the need to maintain, rehabilitate, remove or replace aging infrastructure with something new or different to meet changing conditions and emerging needs.

CALIFORNIA, TEXAS and OKLAHOMA seek funding to implement the projects and programs in their comprehensive state water plans.

The MICHIGAN Department of Environmental Quality identified over \$500 million in unmet funding for nonpoint source pollution projects in 2004.

KENTUCKY needs \$8 billion dollars to improve/expand water supply infrastructure by 2020.

Over 300 infrastructure improvement projects are needed in the six-county GULF REGION of the Mississippi River between 2010 and 2025.

“A top Administration priority is to understand and adapt to climate change through revisions to Federal policies and programs.”

Mr. Jonathan Carson
Chief of Staff
President’s Council on
Environmental Quality
National Collaborative
Water
Resources Conference
Washington D.C.
August 27, 2009

TECHNOLOGICAL drivers are advents in science and technology producing models, databases and data networks, and innovative approaches. Science and technology offer the hope of breakthroughs that can connect people, ideas and continents in milliseconds. Both conceptual and mathematical modeling advance understanding and improved analyses. Models will be especially important in understanding climate change and its impacts by facilitating monitoring and design processes. Geographic information system (GIS) technology, satellite imagery and remote systems are transforming the way that floodplains and watersheds are evaluated and managed. The intermodal inland waterway transportation system benefits from the integration of global positioning systems and GIS data into radar systems that facilitate nautical charting. Technology and innovation can also affect supply, i.e., desalinization can harvest runoff water or reuse brackish groundwater. Development of solar energy is widely promoted. Volumes of water are needed for new energy sources, especially clean water sources like hydropower. The water-energy-food nexus is becoming more important.

ECONOMIC drivers are funding sources and means, budgets, priorities, economic conditions, fiscal policies, investment priorities and strategies, and public-private partnerships. Water transports valuable commodities such as coal, petroleum and natural gas. Foreign trade represents nearly 30 percent of the U.S. economy. Locks, dams, municipal water supply systems, reservoirs, levees, channels, turbines and wastewater treatment plants are continuing to fall into disrepair and decay as capital investment in new water resources infrastructure has decreased by 70 percent over the last 30 years. The current global recession is causing an unprecedented trade crisis in terms of trade restrictions and tariffs on imports, perhaps fostering an era of protectionism. States are faced with severe budget cuts, which reduce their water program funding, negatively affecting the ability to address their critical water needs (such as nonpoint source pollution). The American Society of Civil Engineers (ASCE) gave the Nation’s infrastructure an overall grade of *D* in its 2009 report card yet again. It will take \$2.2 trillion (estimated 5 year investment need) to fix the Nation’s infrastructure. Over half of the Corps locks and other facilities have surpassed their 50-year design life. Failure to maintain and replace infrastructure imperils populations and the economy. In recognition of its economic impacts, infrastructure is a key part of the current Federal economic stimulus package.

ENVIRONMENTAL drivers include ecosystem conditions, environmental management policies, environmental changes and

threats (global warming including climate change and sea-level rise), population growth and geographic redistribution, concomitant economic growth, increasing demand for ecosystem services, and water expended in energy production. There is increased competition for scarce water and declining biodiversity. In addition to a need for habitat restoration, the loss of freshwater species is increasing as ecosystems deteriorate. Environmental values are shifting to promote sustainable development, but this will take technological and cultural change. Environmental *hot spots* include areas where water supplies, competing uses for water and population growth create problems of balancing water demand and supply. For example, Phoenix, Arizona; San Antonio, Texas; Las Vegas, Nevada; Charlotte, North Carolina; Atlanta, Georgia; and a major portion of the Florida Peninsula face expected high population growth in the face of limited available water. Wetlands have been lost or degraded, which endangers major groups of plant and animal life that depend on freshwater systems.

Climate change is destined to affect water infrastructure, ecosystems, water and power operations, water resources food security, human settlements and health—the future sustainability of the planet and resources. It can slow the pace of progress toward sustainable development directly through exposure to adverse impacts or indirectly through the erosion of the capacity to adapt. Climate change will interact at all scales with other trends affecting water, soil and air pollution, thus increasing health hazards, disaster risks, deforestation and the likelihood of conflicts over water uses. Impacts may be compounded by the absence of integrated mitigation and adaptation measures. The Western Governors' Association reports that impacts may include: smaller snowpacks, earlier snowmelt, changes in flood-control releases, more extreme flood events, receding glaciers, more evaporation and dryness, less groundwater availability, more droughts and wildfires, changes in water quality and hydroelectric generation, reduction in waterborne shipping and in recreation at streams and lakes from reduced river flows, and reduced biodiversity.

POLITICAL drivers span governance, roles and responsibilities, Congressional relations, criteria for decision making, advocacy and lobbying. How the Administration classifies and emphasizes benefits for water resources management interventions affects the nature and extent of solutions that are likely to be funded to improve the Nation's water infrastructure. National economic development (NED) has been the primary criterion for making public infrastructure investment decisions for water projects developed by the Corps, the Bureau of Recreation, the

ENVIRONMENTAL CONCERNS OF SELECTED STATES

The GREAT LAKES and MICHIGAN are plagued by water quality problems from contamination.

The SUSQUEHANNA RIVER BASIN is suffering from inhospitable nutrients and invasive species.

The POTOMAC RIVER BASIN is wrestling with point and nonpoint source pollutants from farms and combined sewer and stormwater overflows.

Sedimentation is troubling planners in MARYLAND and VIRGINIA as sediments move from upstream rivers and reservoirs into the Chesapeake Bay.

OKLAHOMA is most concerned that its reservoirs have reached capacity, adding to water shortages from droughts.

GEORGIA is dealing with competition and conflicts over water use from growing recreational pursuits and pressure for water withdrawals.

NORTH CAROLINA state representatives voiced an appeal for more routine dredging in their coastal harbors.

DELAWARE spoke about the need for adequate wastewater and stormwater management and treatment.

ARKANSAS seeks an adequate streamflow to support navigation and ecological needs on the White River in areas of competing use.

POLITICAL AND JURISDICTIONAL CONCERNS OF SELECTED STATES

The GREAT LAKES states have faced a lack of or inconsistent standards, policies and decisions regarding water withdrawals.

ARIZONA, CALIFORNIA, COLORADO, IDAHO, UTAH and WASHINGTON have experienced interstate conflicts over water transfers from rural communities to cities and from one state to another over shared water bodies that cross state boundaries.

Tennessee Valley Authority and the Natural Resources Conservation Service for some time. There is increasing pressure to evaluate justifications for project approval through additional criteria of regional economic development, ecosystem restoration and other social effects, such as benefits of adaptive management, watershed-based approaches and risk-based planning. Changes to the *Principles and Guidelines* that direct project development for the Corps and other Federal resource management agencies have been proposed. The American Recovery and Reinvestment Act of 2009 spurred state governors to identify priorities for water resources projects. However, the lack of clear and consistent policies and poor communication and coordination befuddle states in their water planning. Many states cite the fragmentation of planning processes across their state agencies and across Federal agencies as major challenges. At least 25 Federal agencies, 14 Congressional committees and 50 states are dealing with water issues.⁸ Despite billions of dollars authorized, priorities are established by earmarks and a plethora of legislative, procedural and regulatory guidance.

SECURITY to protect the homeland from internal and external terrorism and other threats is of utmost concern today. Threats to infrastructure come from natural disasters as well. Experts inform us that as the natural system degrades and as climate change brings a greater incidence of extreme events, the natural system will provide less protection from storm surges and the resulting erosion and destruction of coastlines, wetlands and natural barriers, thereby threatening the viability of the homeland. Natural disasters seem to be growing in frequency and severity. Hurricane Katrina, for example, significantly impacted water resources infrastructure in the Gulf States. State officials cite a lack of data and information, tools and technology, models, guidance, research and up-to-date maps as important security challenges. Aging infrastructure is a weak link in effective emergency response for both natural and man-made disasters and will slow down response and recovery efforts. Repeated floods on the Upper Mississippi River System are raising fundamental questions about models and data, flood risk management, and human impacts.

The various drivers or trends interact and are interrelated. Population growth and migration in high-risk areas (e.g., coastal zones) and depletion of natural resources (e.g., wetlands, barrier islands and floodplains) from land use changes have

⁸The Federal Agency Assessment that was developed as part of this initiative provides a summary of 12 key Federal water resources agencies and their programmatic activities.

SELECTED EXAMPLES OF THE IMPACTS OF DRIVERS

As droughts persevere and as surface water supplies diminish, states turn to withdrawing water from their groundwater sources and addressing other threats from the change drivers.

IN THE WESTERN REGION, **Arizona** experienced a 2.5 million acre-feet overdraft of its groundwater, forcing the state to focus on conservation and long-term groundwater management. **Montana** faces surface water rights transfer of rural agricultural lands to meet urban growth. **North Dakota's** aquifers and streams are becoming fully appropriated and permitted for municipal, agricultural, industrial and recreational uses, and thus it must plan for droughts, floods and rising water levels in Devil's Lake. **South Dakota** is besieged by flash floods, long-duration precipitation floods, snowmelt floods, dam failure floods, severe winter storms, wildfires, landslides and mudflows and even earthquakes. The population of **Texas** is expected to more than double between 2000 and 2060, which raises the worry that water supply needs for irrigation, power generation, mining, and municipal and industrial use will not be able to be met in economically feasible ways, especially given the impacts of droughts.

IN THE CENTRAL REGION, as water tables and instream flows have declined, **Arkansas** faces increased water usage for natural gas drilling in the Fayetteville Shales, which in turn raises issues of how to treat or dispose of frac water from fracking. In **Illinois** the state's levees are reaching the end of their design life and need major improvements; however, there is a lack of funding to certify state levees. **Missouri** revised its Drought Response Plan due to the drought from 1999 to 2000, which reduced agricultural crop production, increased costs to supply water to crops and livestock, threatened water quality, reduced water supplies and decreased groundwater levels. Sedimentation and eutrophication (the increase of chemical nutrients such as nitrogen, phosphorus, pesticides, trace metals, bacteria and chlorinated hydrocarbons) are seriously degrading the **Mississippi, Missouri, Ohio and Illinois Rivers**, filling in backwater areas and increasing turbidity, carrying excessive nutrients into the aquatic ecosystem, and allowing pesticides and other toxic chemicals to invade waters. As a result of excess nutrients from the Mississippi River, a hypoxic zone is forming in the Gulf of Mexico that is limiting stratification or layering of waters in the Gulf. This prevents the mixing of oxygen-rich surface water with oxygen-poor bottom water, leading to the loss of fish and shellfish and perhaps the backwaters within the next 50 to 100 years.

IN THE EASTERN REGION, **Alabama** faces water supply stresses from population growth, urban sprawl, and discharges from point and nonpoint sources, which threaten water quality, kill fish, and create consumption advisories. The low level of state funding for environmental protection threatens the state's lakes and reservoirs. Water quality in the rivers and creeks around the **District of Columbia** is bad enough that all swimming is banned. Budget pressures limit maintenance and upgrading of water infrastructure, construction of new water storage tunnels and stormwater infrastructure, and improvements to wastewater treatment plants. **North Carolina** is faced with changing water use from population and economic growth in the Piedmont Urban Crescent and in the Research Triangle. Urban growth here is shrinking available agricultural land and testing water supplies — just as water-based recreation (fishing, boating and swimming) gains in popularity, especially in Jordan Lake. These uses are also competing with drinking water supplies. **Virginia** faces population growth and development in high-risk coastal zones, such as the Chesapeake Bay watershed, which increases the difficulty of evacuating people during emergencies. Insufficient wastewater infrastructure (treatment facilities) will only increase nitrogen pollution. **West Virginia** is concerned that population increases in this region may force **Washington, D.C.** interests to seek water from **West Virginia** for consumptive use.



reduced the resilience of the natural system and limited its ability to provide a buffer to natural disasters. Changes in transportation activity are driven by changes in foreign and domestic trade, logistics practices, environmental constraints, politics, technology and resource parameters. Climate change is deemed an important factor affecting all water resources. The drivers have implications for legislation and infrastructure funding priorities. They present challenges for water resources planning such as governance; continued pressure on the Federal budget from entitlement programs; the need for sophisticated tools to facilitate rigorous analysis critical for prioritizing public water investments; and changes in legislation and appropriations to ensure that water resources and infrastructure needs are met and that impacts of these drivers are addressed.



Water Resources Challenges



Population growth and migration, climate changes, fiscal constraints and environmental trends have been significant drivers affecting states' resource planning to meet their water resources challenges. Table 1 shows that many of these drivers present common challenges across states and regions.

States are additionally challenged by governance issues as the roles of Federal, state, local and nongovernmental entities are becoming blurred and as engineering and environmental expertise grows at large. There is a perceived lack of national direction on water resource issues. Furthermore, as entitlement programs grow to accommodate an aging population and as the U.S. sustains multiple wars abroad, there is growing pressure on the Federal budget and discretionary programs to find funds to support water and land projects and programs. States are especially affected by the decline in Federal funds for water projects and programs in the face of unfunded Federal mandates. Rigorous analytic models/processes are needed to refine project/program priorities. Legislative changes may be called for to enable Congressional appropriations to benefit regional development and to safeguard a high standard of living, not just to serve national economic benefits. Multidisciplinary approaches are needed to address conjunctive uses of water (e.g., surface water and groundwater, water supply and sanitation needs). Intergovernmental collaboration is necessary to address issues ranging from navigation and intermodal transport to flood risk management to alternative energy, to name only a



Table 1 WATER RESOURCES CHALLENGES ACROSS REGIONS		
WESTERN REGION	CENTRAL REGION	EASTERN REGION
Lack of science-based data and information, especially about water use and availability (surface and groundwater)	Lack of science-based data and information, especially about water use and availability (surface and groundwater); insufficient water use reporting; need for research and data systems	Lack of data and access to data and information
Lack of integrated data and databases	Lack of integrated data and databases	
Fragmented planning across state agencies and with Federal agencies	Lack of integrated water resources planning and management	Lack of holistic approaches to water planning and management
Competing uses for water (especially to set minimum stream flows for diverse purposes)	Competing water uses	Lack of balance across competing water uses
Population growth and shifts from farms to city centers or suburbs where water distribution systems are inadequate	Population growth and economic development	Impacts of population growth and economic growth
Aging infrastructure that needs to be repaired, rehabilitated, upgraded, decommissioned or replaced; lack of water storage capacity; inadequacy of distribution system	Aging infrastructure (need to replace, upgrade, rehabilitate, install new)	Aging infrastructure
Degraded water quality from point and nonpoint source pollution	Degraded ecosystems, environmental pollution	Degraded water quality
Budget cutbacks and loss of experienced staff		
Lack of sufficient funding for projects, modeling, monitoring, staff, state water plan implementation	Lack of resources (funds, staffing, processes to determine priorities)	Lack of funding
Use of water to produce alternative fuel sources		
Increasing sedimentation in rivers and reservoirs		
Difficulty in meeting environmental standards		

Table 1 (continued)		
WATER RESOURCES CHALLENGES ACROSS REGIONS		
WESTERN REGION	CENTRAL REGION	EASTERN REGION
Natural disasters, including floods and droughts	Natural disasters, including flooding and droughts	Natural disasters, including flooding and droughts
Climate change and weather impacts	Climate change impacts and information; need for mitigation	
Lack of policies (e.g., for water withdrawals, wastewater management)		
Reservoir operations		
	Regulatory processes for permits; lack of authorities	Excessive regulatory requirements, too-lengthy regulatory processing time
	Conflicts in/competition for use of water	
	Lack of guiding national water resources vision and unified guiding principles	
Loss of streamgages, inconsistent monitoring	Loss of streamgages, inconsistent monitoring	Loss of streamgages, inconsistent monitoring
Interstate conflicts	Interstate issues	Interstate issues
Overuse of groundwater		
Drought planning		
Eroding coastlines		Coastal and beach erosion
Resolution of Indian Water Rights		
Mitigation of climate change impacts		
	Lack of awareness or understanding about water issues	Lack of awareness or understanding about water issues
NOTE: These issues reflect discussions at the regional conferences and may not be inclusive of all issues.		



“Our water resources needs are great. Ports need dredging. The Inland Waterway System is congested. We are losing 90,000 acres of wetlands a year. Developers want to develop our wetlands and bogs, not appreciating their ecosystem value. Nearly half of our streams and lakes are assessed as not clean enough to sustain swimming and fishing. Our infrastructure has been given a “D” grade. The competition for water supply sources is fierce in the Southeast, especially in the Atlanta area. Climate change uncertainty is only making things worse. We are \$58 billion short in investing in our water resources each year.”

Chairman James Oberstar
U.S. House of Representatives
Transportation and
Infrastructure
Committee
National Collaborative Water
Resources Conference
Washington, D.C.
August 27, 2009

few. Collaboration is needed to explore environmental, recreation and stewardship demands. Policies, programs and projects need to be aligned vertically and horizontally. This will take anticipatory planning and participatory governance and transparent, inclusive and consensus-based decision processes and partnerships.

3.1 Addressing the Challenges

States plan to meet immediate exigencies and increasingly develop proactive approaches to anticipate and respond to challenges and needs. This assessment showed that there are at least 50 varieties of water resources planning among the 50 states and the District of Columbia. There is no standard planning approach, process or structure. Water resource planning often occurs in reaction to a crisis situation such as drought, flooding or a natural disaster. The impetus for planning also may be driven by substantial and substantiated research, observed or emerging trends, or the passion of a motivating vision. Shrinking budgets and financial crises compel planning as well. The challenges described above provide the impetus for planning that takes into account the idiosyncratic geography, topography, climate, culture and history of states and their regions. Half of the states have comprehensive water plans that address at least two water functions, primarily planning to improve water quality and to ensure sufficient water supply.

The Western Region is a region characterized by an environment of extremes, most notably scarcity, interstate conflict and rapid change. The West is a set of fiercely independent states that are challenged by droughts and water shortages, population shifts to coasts, eroding coastlines, wildfires, budget crises, and conflicts over water and Indian rights that find their way into the courts for resolution. Fifty percent of the U.S. population resides in the 17 contiguous Western Region states. Seven of the ten fastest-growing states in the U.S. are in the West, including **Arizona, Colorado, Nevada and Utah**. Sixteen of the 19 Western Region states (including **Alaska and Hawaii**) have statewide plans—the highest proportion of any region. Solutions to water challenges in the West must respect the states’ individualism and the water doctrine of prior appropriation water rights. Data-driven collaborative planning is ubiquitous with planning largely occurring in a bottom-up fashion with local watershed groups. The rugged individualism and strong independence of the West is grounded in the view that



the states themselves are the primary water planners. It should be noted, however, that the Federal government is a large landowner/manager in the West.

The **Central Region** is a riparian-rich region. This area has a nationally significant ecosystem and navigation system. The Central Region is challenged by flooding and occasional droughts, conflicts over water withdrawals and serious water quality degradation. The rivers in this region have experienced severe floods, most severely from Hurricanes Katrina and Rita in 2005 on the Mississippi River. Environmentalists and fish and wildlife enthusiasts are most concerned about dredging associated with navigation. Furthermore, agricultural runoff has increased turbidity, siltation, pollution from pesticides, toxicity and eutrophication, leading to loss of aquatic organisms and depletion of oxygen. The Central Region is a set of states with a deep partnering history grounded in compacts and agreements over water withdrawal and use. Planning is primarily bottom up and focused at the regional level.



The **Eastern Region** is defined by strong interstate compacts and active river basin commissions. This region is characterized by historic flooding and protracted droughts of historic proportions in the Southeast and problematic conflicts over water withdrawals in lakes and rivers as explosive growth strains water supplies. Citizens fear a lack of drinking water. Farmers express concern about too little water for agriculture. Fragile ecosystems are threatened. Environmentalists decry the loss of freshwater mollusks, and fishermen worry about the multi-million-dollar fishing and shellfish industry. The need for water for energy often conflicts with the need for drinking water. Coastal erosion from storms is wearing away the coastlines that buffer the effects of flooding, and aging water infrastructure is also deteriorating. The Eastern Region states are challenged by natural forces and the lack of funding. They expressed interest in addressing water needs holistically within and across states in the spirit of sharing information and resources for shared beneficial effects in an era of declining resources.

What unites the states in a region are common challenges, and across the three regions these common challenges include: climate impacts, increasing competition over water, limited water supply sources, maintenance of minimum flow levels in rivers and tributaries to serve multiple water uses, water supply pressures from population growth and migration, disconnects between upstream and downstream policies and impacts, inconsistent water policies and regulations, conflicting priorities, degraded water quality, conflicts over water rights and Indian



water claims, water conservation, funding and staff shortages, aging infrastructure, lack of water data and information, lack of sophisticated tools and technology, outdated maps, growing water demands for energy production, poor stormwater management, and multiple responsibilities and jurisdictions for the same water bodies.

Participants in the three regional conferences around the Nation reported that they need the following:

- Sustainable resources—ecological, financial and political support—especially sustainable funding.
- Planning assistance to develop comprehensive, long-term and strategic plans for a secure water future.
- Reliable water supplies.
- Easy and expedited access to information that helps them understand their resource conditions and plans.
- Protection and maintenance of critical water infrastructure.
- The ability to depend on Federal disaster assistance.

To address common water challenges, the majority of states specifically expressed a desire for:

- Resources to implement their state water plans, to hire staff and to achieve program goals.
- Integrated planning at a watershed scale to better balance diverse water needs, to set minimum flow levels, and to ensure that reliable water supplies will be available in the future.
- More concerted attention paid to aging infrastructure and justification for new infrastructure.
- Greater access to more complete, comprehensive and current data and information, especially about water condition, use and availability.
- Investments in information creation and analysis, and more data sharing.
- Research (e.g., on climate change, investment decision models, risk-informed floodplain management).
- Modeling (e.g., of hydrologic processes given environmental changes, of the interdependencies of projects in a river system).
- Faithful and consistent reporting of water availability and use.



- Regular monitoring and assessment.
- Regulatory processes streamlined to expedite permit approvals.
- More case studies—both successes and failures—of integrated water resources planning.
- Additional dialogue about the development of a national water direction (vision) supported by diverse stakeholders that could be implemented through clear guiding principles.
- Attention to governance, effective leadership and management with defined roles and responsibilities.



Planning and policy changes may be needed, especially to achieve improved water quality and reduced environmental pollution to protect ecosystems and to address declining biodiversity. Better coordination and integration at a watershed scale with integrated and systems approaches will help to integrate land and water plans and policies by active stakeholders at a regional level for sustainability of a wide range of economic, environmental and social resources. Attention to governance issues holds promise to provide effective leadership, a well-defined scope of responsibilities, and perhaps a national direction for integrated water resources management with feedback provided by adaptive management strategies.



STATES' TOP NEEDS

- Create an information hub for access to more comprehensive and accurate data and information, including GIS-based and risk-informed maps, in support of water resources management. Share data and information more widely and readily.
- Use comprehensive, holistic and systems-oriented planning processes for integrated water resources management within a sustainability paradigm.
- Attend to water infrastructure by ensuring its operation and maintenance, rehabilitation, removal or replacement with new infrastructure.
- Promote greater collaboration, coordination and communication among water resources stakeholders to derive agreed-upon plans and management decisions.
- Seek to balance competing water uses and to avoid or resolve conflicts over water use.
- Seek technical planning assistance and expertise to improve water resources assessments, planning and management within a holistic systems perspective that aims to balance objectives.
- Improve regulatory processes to streamline permitting and reduce regulatory burdens.
- Practice and reinforce adaptive management in collecting and analyzing water resources information to understand what is working or not working and why, and to improve performance.
- Improve water quality in rivers, streams, tributaries, lakes, reservoirs, oceans and other water bodies.
- Explore developing a unifying national water direction with guiding principles.



Approach to a More Sustainable Water Future



The complexity of water issues is such that new approaches and solutions are needed. As Ms. Jo-Ellen Darcy, Assistant Secretary of the Army for Civil Works, told those gathered at the National Collaborative Water Resources Conference, **“You go it alone and you may end up standing alone.”** Problems are of a magnitude and so interconnected that they necessarily require joint approaches and solutions for water systems. Progress will require technical and administrative approaches to address water challenges and needs. It should be noted that progress has already been made by the proactive and aligned efforts of field organizations within Federal agencies, states and regional groups to work toward integrated water resources management for sustainable outcomes.

The data, information, insights and opinions of those who participated in the *Collaborating for a Sustainable Water Future* initiative are voluminous. At this time a few examples of actions that can be taken are suggested for each theme. Some short-term actions can be taken now; long-term actions remain to be developed further in an *Implementation Plan*. Detailed recommendations and plans need to be fleshed out, taking specific information about states’ place-based needs and opportunities into account. The Corps has already begun to catalog specific state information generated by this assessment to highlight where particular water and related resource needs exist for a subsequent interagency team to evaluate and work on together.





This report provides a broad and forward-looking approach. It is not a detailed technical report summarizing the findings of the assessment of states' needs matched to Federal capabilities. Thus, Phase 1 of this effort is a descriptive assessment with general suggestions for a more unified forward path. Phase 2 will be a more prescriptive focus with a detailed *Implementation Plan* to foster continued dialogue toward agreements and actions for a more sustainable water future. Additional reported and suggested action items that resulted from this initiative will be included in the *Implementation Plan*.

The following are nine overarching themes and proposed recommendations generated by this initiative:

1. **Integrated Water Resources Management (IWRM)**
Make integrated water resources management more understandable and a preferred way to plan and manage public water and related land resources as a system.
2. **Governance and Management**
Strive to revitalize and/or reshape means at all levels of government to improve water resources management, decision making and evaluation in ways that build the public will to act for integrated water resources planning and management.
3. **Future National Water Resources Direction**
Foster continued dialogue about a sustainable national water resources future direction and develop supporting strategies to elevate water resources and related infrastructure as a critical national priority.
4. **Collaboration**
Promote opportunities and mechanisms for collaborative water resources planning and management.
5. **Water Resources Investment Strategies**
Promote and develop innovative and sustainable financing mechanisms for public water resources solutions, including water infrastructure, at Federal and state levels.
6. **Managing Extreme Events**
Increase the ability to anticipate risks and manage emergency and evolving natural or man-made disasters, especially as related to water resources.
7. **Technology Transfer and Knowledge Capacity Building**
Base the development of water resources plans and decision making upon good science and the sharing of information and technology. Increase scientific and management knowledge and technology/technological capabilities at all levels of government.



8. **Enhanced Water Resources Leadership**
Build and reinforce leadership and stewardship for responsible water management among water professionals across Federal, tribal, interstate, and state agencies and at large.
9. **Communications and Education**
Enhance the ability of public officials at all levels and public and private water resources stakeholders to understand and communicate priorities for water resources through awareness-building, formal and informal education, learning initiatives, public outreach and communications activities.

4.1 Integrated Water Resources Management (IWRM)



Recommendation: Make integrated water resources management more understandable and a preferred way to plan and manage public water and related land resources as a system.

Integrated water resources management is becoming a more familiar approach in states, although there is still lack of understanding about what it means. There is no such thing as an isolated water resource; all resources are parts of larger systems. IWRM highlights the interconnectedness of resources, resource managers, stakeholders and resource decisions so as to pull elements together for comprehensive planning rather than leave them fragmented. Key IWRM concepts include holism, systems, watersheds, participation, balance and sustainability. IWRM plans consider surface water and groundwater (conjunctive use), quantity and quality, river and watersheds, and inland and coastal waters together as a whole; place projects in the context of a large geographic region; entertain multiple stakeholder interests and priorities; and respect the authorities, perspectives, roles and responsibilities of diverse government levels.

International experts define integrated water resources management as:

- Sustainable outcomes—the practice of making decisions and taking coordinated actions for outcomes and benefits that use or affect current economic, environmental and quality of life resources conditions in ways that preserve these resources for future generations.

EXAMPLES OF INTEGRATED WATER MANAGEMENT IN SELECTED STATES

OREGON'S 2007 Oregon Water Supply and Conservation Initiative aims to build an integrated water resources strategy that provides a long-term foundation through a statewide demand forecast out to 2050, an inventory of potential conservation projects, an inventory of potential above- and below-ground water storage project sites and basin-yield and peak flow analyses.

RHODE ISLAND has attempted to drive its water resources planning with a comprehensive systems model based on scientific knowledge, continuous baseline monitoring, indicator-based trend analysis, and an evaluation of program outputs and outcomes that emphasizes learning and adaptation. The Rhode Island General Assembly created the Rhode Island Bays, Rivers, and Watersheds Coordination Team in 2004 across state agencies to develop an integrated systems-level plan to coordinate projects, programs and activities in five major challenge areas: climate change; waterfront, riparian and coastal development; watersheds and water quality and supply; water-reliant economies; habitat restoration; and aquatic invasive species. The systems plan aims to provide an ecosystem-based management approach to water and watershed management and water-reliant economic development that acknowledges and functions within contemporary networks of environmental governance, economic development and, increasingly, energy sectors.

EXAMPLES OF INTEGRATED WATER MANAGEMENT IN SELECTED STATES

CALIFORNIA espouses support for integrated, reliable and secure water resources management systems. Integrated regional water management enables regions to implement strategies to become more self-sufficient. The updated State Water Plan includes an integrated flood management emphasis with a focus on resource sustainability. The CALFED Bay-Delta Program has attempted to balance water supply, water quality, ecosystem restoration and levee system integrity objectives.

HAWAII'S Statewide Framework for Updating the Hawaii Water Plan provides guidance to integrate the Commission on Water Management's Water Resources Protection Plan, the Department of Health's Water Quality Plan, the Department of Land and Natural Resources' State Water Projects Plan, the Department of Agriculture's Agricultural Land Use and county Water Use Development Plans at a watershed level to manage land and water as a system from mountains to the ocean.

MICHIGAN considers the entire hydrologic system of the Great Lakes as a single integrated system of interconnected surface and groundwaters treated as a whole.

- Collaborative planning—a process that avails collaboration to secure the input of all stakeholders about their interests and needs.
- A systems perspective—a systems approach that arrays interests and needs as input variables, modelling a system of interdependent variables with multiple outputs.
- A geographic context—a geographic perspective that examines who is doing what where at a broad geographic scale, e.g., a river basin, watershed or coastal zone.
- Balanced aims—a process that seeks to balance multiple objectives as diverse desired outputs producing multiple benefits.

The Global Water Partnership, founded in 1996 among the World Bank, the United Nations Development Programme, the Swedish International Development Agency and entities (governments, public institutions, private companies, professional organizations, multilateral development agencies) involved in water management, who are committed to principles of sustainability for a water-secure world, defined IWRM as *a process that promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.*

The following definition was developed at the regional conferences (beginning with the Eastern Region Conference) and was used by participants for this initiative:

IWRM aims to develop and manage water, land, and related resources, while considering multiple viewpoints of how water should be managed (i.e. planned, designed and constructed, managed, evaluated, and regulated). It is a goal-directed process for controlling the development and use of river, lake, ocean, wetland, and other water assets in ways that integrate and balance stakeholder interests, objectives, and desired outcomes across levels of governance and water sectors for the sustainable use of the earth's resources.

This definition suggests that state watershed-based plans should reflect an appropriate balance between economic and human uses and ecological and environmental benefits. States

may modify this definition to view conjunctive management of surface water and groundwater as integrated water management or to achieve a sustainable balance of water uses and water supplies. Federal agencies may define IWRM in a broader context consistent with their expansive and varied roles.

Nationwide progress toward IWRM has been hindered by: the lack of common definitions of terms and approaches and decision frameworks; governance issues; data and model needs; economic and political factors; disjointed and uncoordinated planning across state boundaries and agencies; fragmented and conflicting authorities; and unclear, conflicting or overlapping agency responsibilities. Still, participants in this initiative supported IWRM as the preferred approach to planning to overcome fragmentation and ad hoc approaches.



States today are increasingly adopting a *watershed approach* to implement IWRM. Many of the states that have a state water plan, at a minimum, seek to integrate water quality and water quantity. States increasingly call for greater integration of land and water resources, especially surface and groundwater. Integration takes the form of multiobjective planning across diverse water uses with multiple stakeholders to balance needs and outcomes, plan jointly for water quality and quantity, consider downstream impacts of upstream actions, coordinate plans and actions across state agencies for horizontal alignment, integrate disaster planning into water resources planning, and look at an entire watershed or river basin as a system of interrelated parts.

Many of the river basin commissions and other interstate organizations exemplify the practice of IWRM by promoting a systems context for effective water management. The Delaware River Basin Commission (DRBC) is a respected example, although it is perhaps unique because of its regulatory authority. The DRBC's mission is to provide leadership to restore the Delaware River. It serves as a policy-maker, regulator, planner, manager, educator and mediator in partnership with four states (Pennsylvania, New York, Delaware and New Jersey) and the Federal government. The DRBC's focus is comprehensive watershed and water resources planning, management, regulation and conflict resolution with a detailed focus on protecting surface and groundwater quality, water supply allocation and conservation, instream flow management, flood loss reduction, drought management, regulatory review and permitting, recreation, inter-agency coordination, mediation of interstate disputes, and public education and engagement. The DRBC uses planning principles to set sustainability goals within

HOLISTIC STRATEGY OF THE DELAWARE RIVER BASIN COMMISSION

The Delaware River Basin Commission advocates the following strategy for the Land and Water Resource Management Key Result Area:

Land and Water Resources Management—seek the integrated management of land and water resources to sustain the quality of life in the Basin; preserving, restoring and enhancing ecological resources while recognizing the community’s social and economic relationships to these resources. Because land and water resources are inherently related—water resources are cycled within a watershed—it is necessary to consider the interconnections of land and water resources in decision making and to incorporate a watershed framework into community, regional, and statewide decision-making structures.

a unified water resources framework linked to *Key Results Areas* dealing with hydrology, water quality, living resources and landscape. Together with state water plans and strategic plans, the DRBC provides plans and a tracking system for a systems view of the Delaware River with concrete data and integrated information that can help planners, policymakers and decision makers. The DRBC’s *The Water Resources Plan* provides guidance and direction for setting policy and management decisions. *The Comprehensive Plan* documents the ongoing projects and activities designed to carry out *The Water Resources Plan* through a detailed *Matrix of Goals and Objectives* for multiple and balanced objectives, including milestones, desired outcomes, strategies and quantifiable performance indicators. Results are described in the *State of the Basin Report* (2008) in terms of specific performance measures, targets, and baselines for each *Key Result Area*. Performance results are summarized in graphs, tables and figures that document inputs, throughputs and outputs.

Suggested Actions:

1. Pursue legislation to better enable Federal agencies to integrate programs across agencies and to serve an integrator role to coalesce Federal resources for the benefit of states.
2. Promote understanding about integrated water resources management through clear examples, exemplars and case studies of effective planning and management.
 - a. Illustrate alternative watershed-scale systems approaches to IWRM based upon concepts and definitions in practice by Federal, state and local agencies, tribes, interstates commissions and nongovernment organizations.
 - b. Identify watersheds to describe and assess opportunities to promote more IWRM.
 - c. Exemplify IWRM (including adaptive management strategies) through demonstration watershed-scale projects and case studies.
3. Promulgate policies, concepts, and clear and consistent definitions that support integrated water resources management. Ensure wide use and implementation of EC 1105-2-411, Watershed Plans, to reinforce IWRM.
4. Collaboratively develop communication materials that highlight good case examples of IWRM, and strategically communicate about them to diverse audiences.

CONFERENCE SPEAKERS ENDORSED IWRM

Watershed thinking is needed along with good science to promote collaborative regional and local watershed planning to meet future needs.

Mr. Mark Miller
Director, Illinois Department of Natural Resources
Central Region, Collaborative Water Resources Conference
St. Louis, Missouri, June 2009

You need lots of interlocking arms, sound science, and up-front time to build trust and transparency, and the willingness to be a good listener and to step into another's perspective to make watershed management work.

Ms. Carol Collier
Executive Director of the Delaware River Basin Commission
Western Region, Collaborative Water Resources Conference
Kansas City, Kansas, April 2009

We're all in this watershed together. We have to find out how to work together to solidify relationships. Tribes have the chance to lead collaborative efforts to raise awareness of water issues and how they all fit together to better understand the water resources we need.

Mr. Wes Martel
Chairman, the Indian Water Working Group
Central Region, Collaborative Water Resources Conference
St. Louis, Missouri, June 2009

Integrated water resources management is tough. It takes time to build a common understanding but we must focus on a desired future. It takes a vision. It takes a comprehensive approach, clear priorities among water users and uses. It takes science-based and adaptive actions and a sound institutional framework. It takes the best and brightest. It takes leadership. It may take a change in policies and behavior. We need to start with the "sweet spots."

Dr. Denise Reed
Professor, New Orleans University
National Collaborative Water Resources Conference
Washington, D.C., August 2009

We must overcome the ad hoc approach to water policy and work together in interdisciplinary teams toward a national water vision, based on overarching principles and sound science, for better coordination of Federal water resource policies for watershed-scale water resources assessment and planning.

Mr. Richard Engberg
Technical Director, American Water Resources Association
Eastern Region, Collaborative Water Resources Conference
Orlando, Florida, February 2009

All of the elements of an integrated water resources management approach are available in the Federal water agency programs. Moving forward will take better coordination between Federal agencies and state and regional entities through an inclusive process.

Dr. Matthew Larsen
Associate Director for Water, U.S. Geological Survey
National Collaborative Water Resources Conference
Washington, D.C., August 2009

4.2 Governance and Management



Recommendation: Strive to revitalize and/or reshape means at all levels of government to improve water resources management, decision making and evaluation in ways that build the public will to act for integrated water resources planning and management.

Action is propelled when people are enabled to act by virtue of some authority, structure or function and have sufficient resources to act. Fragmentation regarding authorities and policies, overlapping and redundant responsibilities, conflicting foci and priorities, differences in planning approaches and the lack of operational definitions hinder effective integration of efforts and aligned decisions about infrastructure investments. Roles need to be clarified. Mechanisms facilitating IWRM can join efforts toward common goals and across levels of government. Legislation may be needed to overcome the extant short-term view and attention to localized needs through a narrow lens. Mechanisms need to be found or established to facilitate information sharing, collaborative work and joint budgeting. Times, conditions and planning assumptions have changed and so must structures to accommodate the water resources needs of today. The Western Governors' Association summarized the situation in a 1989 white paper on Federal Water Policy Coordination:

“A principal characteristic of Federal water policy is that policies are made in an ad hoc, decentralized manner. No agency of the executive branch or committee of Congress is responsible for keeping an eye on the ‘big picture.’ Thus Federal water policy lacks a unifying vision or even a set of guiding principles. A host of problems are created by, or at least are related to, the absence of a unifying vision, including redundancy of functions across programs, protracted disputes, interagency turf battles, absence of policies and lack of finality of many water disputes.”

Furthermore, a 1998 report entitled *Water in the West: The Challenge for the Next Century* by the Western Water Policy Review Advisory Commission and published by the Western States Water Council concluded, “At a time when our water

resources policies are in such rapid transition, it is remarkable that there is no regular forum for discussion of these issues by involved Federal officials.”

The conclusion of the second national Water Policy Dialogue sponsored by the American Water Resources Association in January 2005 highlighted the need for an effective governance structure:

“There is a need to reconcile the myriad laws, executive orders, and Congressional guidance that have created the current disjointed ad hoc national water policy and to clearly define our 21st century goals and objectives. Many important laws were passed early in the last century, when national objectives and physical conditions were far different. Many of these documents conflict with each other, placing executing Federal departments in tenuous and sometimes adversarial situations by creating disharmony among states and localities.”



The *Federal Agency Assessment* report completed as part of this initiative noted that agency culture may hinder multiplistic thinking in favor of a single-minded way of approaching issues. It highlighted potential conflicts from different mandates and legislative authorities or duplication in authorities. One official interviewed for the report summarized that the structure of Congressional committees with overlapping responsibilities concerning water does not necessarily promote a comprehensive approach:

- Congressional committee structure hobbles the ability to have a unified approach, although Federal agencies are doing what they can to better coordinate with each other.
- Congressional committees need to be better aligned. They determine which agency gets work and the nature of the work. The lack of coordination and integration at the Congressional level creates alignment challenges for the Federal agencies.
- We need to examine the Federal role in light of today’s needs and realities. As previously discussed, states have increased technical capabilities and don’t need to rely on the Federal government for basic expertise. However, there is a role for the Federal government in interstate water issues, in broad



emerging issues like climate change, in R&D and in tribal responsibilities.

- Establish interagency mechanisms to promote a national future direction.

Speaking at the National Conference for this initiative, the Honorable Chairman James Oberstar, Chairman of the U.S. House Committee on Transportation and Infrastructure, noted the dysfunction that comes from fragmentation:

“There are 24 Federal agencies with water responsibilities and this does not count the land management agencies with related responsibilities. Policy is ad hoc, implementation is decentralized, coordination is fragmented, and communication is nonexistent or fails to connect. We need a national water policy and unifying vision and guiding principles. I want to introduce legislation to pull our Federal water resources together.”

Nonetheless, there is commonality and overlap across Federal resource agencies mission, authorities and programs, especially related to clean water. An immediate way forward is to explore these commonalities among agencies. Then it behooves the Congress, the Office of Management and Budget (OMB) and the Federal government to streamline and reduce the redundancy and ambiguity in authorities—especially environmental authorities—under Federal purview and to clarify roles and responsibilities of agencies and levels of government. There is a need today for interagency coordination through some formalized means to facilitate cross-agency information sharing, coordination and opportunities to leverage resources.

It would be possible to move ideas to action in more unified ways if a horizontal structure were in place across Federal resource agencies and a vertical structure existed across levels of government and with nongovernmental entities. Simply getting all the players together within a river basin to find out what is taking place and then discussing how work can be better coordinated and integrated is a way to start. There are many best practices of, and people and organizations promoting, coordinated action and information sharing at the local watershed level on which to build. Any mechanism must facilitate both bottom-up and top-down efforts.

Integrated Federal water resources management could also be supported by a unified Federal policy for a watershed/systems

approach. The Departments of Agriculture, Commerce, Defense, Energy and Interior; the Environmental Protection Agency; the Tennessee Valley Authority; and the Army Corps of Engineers were joined on October 18, 2000, through a *Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management* as an action item under the Clean Water Act to prevent degradation of high-quality waters and to accelerate the restoration of degraded water resources; however, this initiative ended after the changeover of Administration in 2001.

Informal mechanisms have emerged, perhaps out of a growing need to develop sustainable strategies in the face of global warming. The WestFAST (Western States Federal Agency Support Team) structure of an assigned Federal liaison that is positioned to expedite coordination across states in the West and with Federal agencies in the Western Region is an example.⁹ Many who attended the regional and national conferences for this initiative expressed the opinion that a similar structure (e.g., a CentFAST and an EastFAST) would be invaluable in the Central and Eastern Regions. Interagency forums have spawned interagency working groups for follow-on work, some of which have led to formalized partnership agreements. Yet enabling formalized entities to work requires sustained resources.

The Integrated Water Resources Science and Services (IWRSS) project of NOAA provides a working example of how to align agencies through the governance structure of a consortium as a building block for a *Federal Support Toolbox*. The agencies involved (USGS, the Corps and NOAA) have proposed a governance structure that spans planning teams focused on specific activities up through a project management level to an executive level, with future frequent engagement with organizations such as the Federal Advisory Committee for Water Information (ACWI) to gather input. The notion is to develop a roadmap through regular meetings to plan and share information across scales (from small hill-slopes to large watersheds, from droughts to floods, and from historical analyses to long-range predictions).

Participants believe that a unified national water resources vision with *Guiding Principles* and specified roles and responsibilities could go far toward focusing water resources priorities and integrating water and related land resources management. Clear roles and responsibilities will enable a governance structure to work. Some of the current fragmentation and lack of



⁹See <http://www.westgov.org/wswc/WestFAST.htm> for the charter and work plan of WestFAST and current activities.



coordination hinges on the fact that roles and responsibilities have not been clearly defined or are not clearly understood. A result is that water priorities may reflect conflicting needs or may not fully meet states' needs inasmuch as projects are not necessarily approved in a watershed or regional context to reinforce long-term resource sustainability. Roles and responsibilities should be clarified so as to accommodate new needs and capabilities among the various water resources stakeholders at multiple levels.

There is a clear and compelling need for an integrator to collect and share relevant information, to highlight key issues and critical needs, to synthesize information, to bring resources to bear for viable solution options that promote sustainable results, and to target education to breed support for initiatives large and small. The Corps is willing to continue to facilitate a continuing dialogue within its current authorities in ways that enable integrated water resources management as requested by participants of this initiative. Continuing discussion is needed to evaluate if new authorities are needed by Federal agencies, including the Corps, and if funding mechanisms should change to better support states in doing integrated water resources management.

Suggested Actions:

1. Seek and seize opportunities to align existing water resources programs among the Federal family of resource agencies in order to increase consistency and unity of effort for common aims, particularly in support of states.
2. Revisit or establish a new mechanism for consistent interagency water policy, project development and coordination.
3. Encourage the Council on Environmental Quality to play a facilitator role to coordinate Federal water and related resources policy across Federal agencies, as it is currently doing with respect to climate change, the cleanup and restoration of the Chesapeake Bay, floodplain management and revision of the *Principles and Guidelines*.
4. Make water resources management policy more consistent and supportive of IWRM.
5. Revisit the *Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management* produced in October 18, 2000, to help implement the Clean Water Act for watershed/system approaches or draft a new document that is applicable to current circumstances.

6. Formalize the existing Federal Principals Group to coordinate Federal policy and programs for integrated water resources management and assistance to states and interstates for comprehensive and regional water resources management.
7. Pursue legislation that gives the U.S. Army Corps of Engineers a role/mission to support integrated water resources management.
8. Sustain and promote the role of the interstate organizations as a mechanism to facilitate comprehensive and regional water resources assessment/evaluation, consensus-building, education, planning, management and conflict resolution.



4.3 Future National Water Resources Direction



Recommendation: Foster continued dialogue about a sustainable national water resources future direction and develop supporting strategies to elevate water resources and related infrastructure as a critical national priority.

At regional and national conferences significant interest was expressed in support of a national water resources vision that can portray a compelling future direction for water resources management that stakeholders can support and subsequently turn into guiding principles and policies.

A vision is a vivid description of a desired future. It implies a picture of an ideal end-state or outcome years out. It is not a detailed plan sufficient to engage everyone in specific activities; rather, it influences future policies with recognizable and agreeable themes that guide supportive activities. A vision has been likened to a watercolor painting: it provides a recognizable image; it is not a photograph. It is compelling, powerful and clear enough to incline people to move toward the desired end-state. As a mental picture of a target to aim for in planning to close the gap between current conditions and a desired future state, it inspires and rallies the will to act. The power of a water resources vision is to drive the Nation's water future through integrated water resources management for sustainability across the country.

At the National Conference the President of the American Water Resources Association, Dr. Ari Michelsen, claimed that



actions will remain ad hoc, fragmented, unlikely to achieved desired end-states and potentially ineffective without a vision. Dr. Denise Reed echoed that a future vision can promote integrated water resources management through a better understanding of the range of expected and unintended consequences, by identifying common goals, and by considering multiple water uses and the synergies, conflicts and trade-offs involved. Ms. Deborah Ingram, Acting Administrator for Mitigation at FEMA, claimed that we need a national vision and can craft it with insights garnered from what is working in centers of excellence, pilot projects and best practices. Ms. Carol Collier, Executive Director of the Delaware River Basin, summarized the imperative to come up with a program that works based on a vision, guiding principles, and specific strategies. “Then we need to get funding to make it work,” she exhorted.

Useful visions are lean, i.e., elegant in their simplicity. The Clean Water Act paints a clear and simple-to-understand vision of *fishable, swimmable, and drinkable water resources*. The Safe Drinking Water Act seeks *reliable, safe drinking water across the Nation*. In stating his intent at the National Conference to develop a 200-year vision for the Mississippi River—America’s River—at the Central Region Collaborative Water Resources Conference, Major General Michael Walsh, Commander of the Corps Mississippi Valley Division and President of the Mississippi River Commission, said, “We must craft a vision to ignite the passions of people and an intergenerational commitment to value it and protect it.” A vision will provide a roadmap to address the full range of water resources issues facing this Nation. Mr. Joseph K. Hoffman, Executive Director of the Interstate Commission on the Potomac River Basin, stated, “If you can dream it, you can do it. We all have a dream to see better water management in some form. Let’s find a way to do it better. Our water infrastructure won’t take care of itself.”

The expressed and implied vision statements and goals of states in their state water plans, strategic plans or state agency/department mission statements generally express a desire to: sustain resources for future generations; protect human health and quality of life (including recreational pursuits); protect flora and fauna; and foster economic development through responsive, effective and efficient policies, plans, programs and management strategies. Sometimes this is achieved through integrated water resources management processes for beneficial uses of surface water and groundwater, and often through partnerships.

Throughout this initiative, several sample vision statements were offered by conference participants to initiate the crafting of a national water vision:

Example 1: We will manage the Nation’s water and related land resources holistically to provide groundwater and surface water of sufficient quality and in adequate supply to protect our natural systems and provide for potable supplies, agriculture, industry and recreation in a sustainable manner. Through enlightened planning for and management of water resources, the health, safety and welfare of citizens will be safeguarded during times of flooding and drought, and an informed public will be involved in resolving water resources issues.



Example 2: Adequate supplies of sustainable freshwater of good quality that ensure food production and manufacturing needs, protect sources and national treasures, share when necessary with neighboring countries, and are stored, transported and protected by safe and adequate water resources infrastructure must be available to all persons and all other existing life forms in the United States.

Example 3: We will manage the Nation’s waters holistically to benefit the living world. We will protect natural systems and manage the land and water resources in a sustainable manner to provide for potable supplies, agriculture, industry and recreation.

Example 4: We will manage the Nation’s water resources by implementing integrated water resources management (IWRM). IWRM involves planning and implementation championed by the tribes and states with financial resources and expert technical support provided by the Federal agencies. This collaborative effort involving tribes, Federal agencies, states and local entities along with robust public participation will enable implementation of plans to provide adequate quantities of good quality water for all beneficial uses.

Example 5: We will manage our waters and watersheds in an integrated and sustainable manner to provide groundwater and surface water of sufficient quality and in adequate supply to sustain our natural systems and strengthen supplies for our homes, farms, businesses and recreation areas. We will enhance the health, safety and welfare of our communities, despite



recurring floods, droughts and competition among uses, through science-based planning led by the states and interstates, robust expert evaluation, active collaboration across all levels of government and the direct involvement of a well-informed public. [Offered for consideration by the Interstate Council on Water Policy (ICWP).]

The revision of the *Principles and Guidelines*, the process used to direct Federal water project investment, provides an opportunity to shape guiding principles and policy for water management.

A vision can be developed top down or bottom up, but most participants favored a bottom-up approach with a wide stakeholder group, especially those at the local watershed level. The American Water Resources Association (AWRA) offered to lead a blog discussion about the need for and desired elements of a national water resources vision.¹⁰ AWRA is consolidating the input it received. The Corps offers to facilitate a continuing dialogue about a Federal water vision across the Federal family. Although not everyone agrees that a national vision is needed, most agreed that continued discussion would be beneficial.

The Interstate Council on Water Policy stated:

“Some are concerned that developing a national vision statement will divert attention from the more important need to determine how Federal agencies and water programs can support and enhance state and interstate water planning. However, other members believe that establishing a national statement will help elevate sustainable water management as a national priority.”

Mr. Thomas M. Iseman, Program Director for Water Policy & Implementation of the Western Governors’ Association (WGA), emphasized at the National Conference that “The WGA supports many strategies for sustainable water resources planning and management. Let’s continue this conversation.” He offered the WGA’s vision statement:

“Protect and wisely manage our national water resources for the benefit of present and future generations, including our environment.”

¹⁰See: <http://awramedia.org/mainblog/2010/01/05/should-the-usa-have-a-national-water-vision-what-should-it-be-an-invitation-to-comment/>

Many people have called for both a vision and water policy, but water policy is not the same thing as a future vision for water resources management. A policy for water planning and management supports achieving a vision or may serve to provide guidance in lieu of it. The 1998 Western Water Policy Review cited the need for Federal agencies to coordinate and integrate their programs and initiatives. The Bureau of Reclamation's *Water 2025* report (2003) called for principles to guide water management decisions. The Western Governors' Association issued reports in 2006 and 2008 recommending a Federal-state cooperation framework for a sustainable future. The Congressional Research Service once again summarized the challenges of 35 years of water policy by executive and judicial actions and piecemeal legislation with no clear vision in its 2009 report, *35 Years of Water Policy: The 1973 National Water Commission and Present Challenges*. Constructing a water vision has captured the attention of the World Water Forum and the European Union nations, who are working to fashion national visions for integrated water resources management and sustainability and to translate these visions into action through pilot programs. Indeed it is difficult to gain agreement about a vision that applies to everyone in the same way; however, an inspirational statement that encourages activity in a common direction may be sufficient to focus and align intentions and efforts toward common aims.



Were a national water vision to be supported by laws, Presidential Executive Orders, regulations, policies and revised *Principles and Guidelines* for water project development, it could elevate water and its infrastructure to a national level of attention, including in the private sector. Such a vision could focus the Nation on flexible and proactive water resources management for the 21st century and unify effort toward shared goals.

Suggested Actions:

1. Continue dialogue through collaborative workshops, surveys and meetings about the need for a national water resources vision and its elements.
2. If there is a consensus to have a national water vision, create a representative intergovernmental team, with state, tribal and NGO input, to craft alternative vision statements, and conduct workshops and other meetings to seek consensus about a preferred national vision statement.
3. The Federal resource agencies can collaborate on developing a *Federal* water vision to better unify Federal

CURRENT EXAMPLES OF COLLABORATION BY SELECTED STATES

The ARKANSAS and ILLINOIS Conservation, Reserve, and Enhance Program (CREP) is a collaborative riparian restoration program to repair riparian zones on the Illinois River, to restore water quality caused by runoff from the poultry industry and to avoid interstate litigation. This partnership is bringing together public (Natural Resources Conservation Service) and private resources (\$30 million, with \$6 million contributed by non-federal partners such as Wal-Mart). Funds have been spent to plant trees and grasses, and state tax credits have been offered to landowners as an incentive to offset their costs.

The KENTUCKY Drought Management and Response Plan (2008) is a proactive effort among a broad spectrum of 35 to 40 agencies, including Federal and state agencies, farm bureaus, industry (e.g., Toyota) and water companies to develop a drought response plan that is responsive to homeland security issues as well as prevention and mitigation needs.

agencies' direction toward IWRM.

4. Support regional entities in developing regional water visions.

4.4 Collaboration



Recommendation: Promote opportunities and mechanisms for collaborative water resources planning and management.

There are many benefits to collaboration: building strategic alliances to make the most of the resources, aligning goals and objectives, pooling resources and coordinating implementation efforts, to name a few.

The states endorsed collaborative planning and indicated that they had utilized it and were planning to expand opportunities for collaboration to identify water resources needs, define problems, develop solution alternatives, and reach out to inform and educate others. Partnerships are both formalized and informal to focus efforts on common goals related to planning, problem solving and implementing plans together.

Partnering is promoted both top down and bottom up. Public involvement, partnerships and outreach are signatures of water resources planning in the states. On the front end of the planning cycle, stakeholders provide input about their concerns and needs at programmed points in the planning cycle stipulated by policy, law, opportunity or when moved to action; on the back side of the cycle they provide feedback and insights about the feasibility and success of specific policies, programs and interventions. States currently collaborate to share information, tackle problems jointly, coordinate efforts (especially for emergency response) and form strategic alliances, and more would like to do so. Informal alliances and formal partnerships achieve economy of effort, fill neglected gaps and foster joint action for targeted results. As one member of a small regional workgroup said, "You can't go wrong with collaboration, so just do it." Former Secretary of the U.S. Department of the Interior, Dirk Kempthorne, told the Western Region Conference attendees that "We must collaborate or we will die. It's that important."

Collaboration is not necessarily easy. It takes time, effort, reinforcement, funding, commitment and patience. Mr. James

Hess, Associate Director of Operations for the Bureau of Reclamation, offered that there is a need to define *collaboration* better with stakeholders; collaboration is more than holding a public meeting. Understanding common challenges and the culture and politics of the situation, knowledge of relevant authorities, incentives to act or not to act and funding all spur collaboration. Partnerships are codified through *Memoranda of Understanding and Agreement* and compacts signed by the parties involved. Partnerships may be between public entities or with nongovernmental entities and the private sector (public-private partnerships). State representatives and other conference attendees called for revitalizing the river basin commissions to facilitate collaborative interstate and regional planning at a watershed scale. Joint watershed work was noted as an area ripe for collaboration among participants and, in fact, is under way.

There are many examples of effective partnerships, both at the Federal level and between Federal agencies and states. *The Intergovernmental Flood Risk Management Program* among the Corps, FEMA, the Association of State Floodplain Managers (ASFPM) and the National Association of Flood and Stormwater Management Agencies (NAFSMA) aims to identify common issues regarding flood risk mapping and management and to communicate flood risks. This program is reporting on the effectiveness of flood risk reduction programs, developing mutual guidance, fostering communication and information sharing through joint workshops and conferences and providing information to levee districts. *The 'Minnesota Recovers' Task Force* is a flood response team among **Minnesota**, USACE, NOAA, USGS, counties, mayors, sheriffs and other partners established to cut through red tape for local emergency response based on the **California Silver Jackets** program offered by FEMA and USACE. The partners engage in daily coordination for hazard mitigation, restoration, buyouts, and relocation of individuals away from the floodplain.

As an example of collaboration across Federal agencies, the USGS and EPA have joined on the STORET (STorage and RETrieval) database of biological, physical and chemical data about ground and surface waters and the National Water Information System (NWIS) with a common data portal. The USGS also recently partnered with NOAA, the Bureau of Reclamation and the Corps to produce USGS Circular 1331, a comprehensive overview of the impact of climate change on water management.

CURRENT EXAMPLES OF COLLABORATION BY SELECTED STATES

Although prompted by litigation, the COLUMBIA RIVER Federal Principles Group (NOAA Fisheries, U.S. Fish & Wildlife Service, Forest Service, Bureau of Reclamation, EPA, USACE, the Bonneville Power Administration, four states and several tribes) has been working for 10 years to develop a mitigation agreement.

The KANSAS CITY, MISSOURI, Wet Weather Community Panel is a panel of developers, regional planners, civic leaders, businesses, environmentalists, regulators, and the public and neighboring communities to develop plans for combined sewer systems (sanitary sewer and stormwater systems). It is working on policy and goal development, seeking funding sources and recommending solutions through consensus.

CURRENT EXAMPLES OF COLLABORATION BY SELECTED STATES

MARYLAND, THE DISTRICT OF COLUMBIA, PENNSYLVANIA, VIRGINIA, the U.S. Environmental Protection Agency and the Chesapeake Bay Commission are signatories to the regional Chesapeake Bay Agreement with the U.S. Departments of Agriculture, Commerce, Defense, Education, Interior and Transportation, the General Services Administration, the U.S. Postal Service, states (New York, Delaware, West Virginia), academia (e.g., Pennsylvania State University, Smithsonian Institution, University of Maryland, University of Virginia) and local watershed organizations (e.g., Alliance for the Chesapeake Bay, Anacostia Watershed Society, National Fish and Wildlife Foundation, Interstate Commission on the Potomac River Basin, Ducks Unlimited) to restore the Chesapeake Bay through a unified plan. President Obama signed Executive Order 13509 on May 22, 2009, to revitalize leadership to restore the Bay with bold new approaches and renewed commitment. EPA, in response to Executive Order 13509, will chair a leadership committee to develop an integrated restoration strategy to reduce pollution and meet water quality goals, promote targeted conservation, strengthen stormwater management at Federal facilities, adapt to impacts of a changing climate, conserve landscapes, strengthen science for decision making, and conduct habitat and research studies to improve outcomes for living resources.

There are many initiatives to foster partnering between the Federal government and the states, e.g., the USGS Cooperative Water Program since the 1920s, the Chesapeake Bay Program, the Bay Delta Conservation Plan, the Great Lakes Regional Collaboration and the Comprehensive Everglades Restoration Plan. **California's** Department of Water Resources and Game and Fish Department, the Sacramento Flood Control Authority, the U.S. Fish and Wildlife Service, the Corps and FEMA developed a framework to address vegetation and levee deficiencies in the Sacramento Delta so as to balance removal of vegetation with protection of endangered species – a model adopted by Los Angeles and **New Mexico**.

Opportunities for collaboration and partnering include data gathering, monitoring, adaptive management, project development, floodplain management, ecosystem restoration, interstate conflict resolution, infrastructure maintenance and upgrading, emergency management planning, innovation (e.g., carbon trading, nutrient banking), and taking advantage of the desire to be proactive. Throughout this initiative participants consistently voiced their appreciation for the opportunity to interact with counterparts in other states and other professionals engaged in similar work.

Suggested Actions:

1. Make available the missions, roles, experiences, networks and proven track record of the interstate river basin commissions to facilitate coordination and collaboration across member states and for regional water planning and consensus-building. Pursue sustainable funding for the interstate agencies.
2. List and describe the ongoing activities of selected active watershed groups working under Federal, state and local auspices in each watershed/river basin by building a dynamic (open-ended) GIS-based map/database.
3. Mine the data in the regional *Trends Reports*, regional and national *Conference Proceedings* and *Federal Agency Assessment* report to offer ways to match Federal programs and capabilities to state needs in a separate report.
4. Identify gaps and opportunities for building partnerships, building on the lists of gaps and opportunities obtained through this initiative, and propose ways to resolve or take advantage of the opportunities.
 - a. Mine exemplars, best practices and watershed-scale work in the data provided by this assessment to identify opportunities for partnering.

5. Continue to collaboratively work with tribes to resolve water issues on Indian reservations.
6. Identify, approve and fund collaborative demonstration projects in selected watersheds.
7. Identify and promote new and ongoing interagency efforts (e.g., among Federal agencies, states, tribes and NGOs). Build on current forums (e.g., the Sustainable Water Resources Roundtable) for collaboration among Federal agencies to support state/regional water management.
 - a. Support an effort for 50 States and 50 Watersheds or United Watersheds to develop regional multipurpose watershed plans, building on bottom-up collaborative efforts basin by basin. Synchronize ongoing and future watershed and basin-wide initiatives.
 - b. Align with efforts underway that support the intent of this initiative, e.g., the Southeast Regional Water Resource Alliance, the Southeast Natural Resources Leaders Group and the Conference of Southern County Associations regarding solid waste and wastewater, the Corps' effort to form a southeast regional entity around common needs.
8. Explore mechanisms to forge public-private partnership, building on a white paper¹¹ produced by the Corps on how and why such partnerships can or do work. Suggest models and examples for public-private partnerships.
9. Develop a communications strategy and communicate about partnerships for integrated water resources management.
 - a. Develop a strategy to enhance outreach and educational efforts for specific water systems. Increase and formalize partnering agreements for these outreach and education activities as appropriate.
 - b. Building on the information collected through this initiative, develop and publish case examples of what is working well (best practices) or not working and why for selected partnership efforts within specific watersheds.

CURRENT EXAMPLES OF COLLABORATION BY SELECTED STATES

VIRGINIA has developed educational strategies to target youth and students, local public officials and the private sector through web-based and mass media resources and signage programs to engage all persons and corporations interested in or directly affected by a proposed or existing plan or programs so that they all become advocates for watershed-based planning and management at the community level. Similarly, the District of Columbia (Watershed Protection Division in the Department of Environment) trains students and teachers through teacher training programs and fellowships and camps.

¹¹Wilson, E. and N. Starler. 2008. *Budget Constraints and the Corps Consideration of Public-Private Partnerships: Where is the Money Going to Come From?* Institute for Water Resources, U.S. Army Corps of Engineers, Alexandria, VA.

4.5 Water Resources Investment Strategies



Recommendation: Promote and develop innovative and sustainable financing mechanisms for public water resources solutions, including water infrastructure, at Federal and state levels.

Chairman Oberstar of the House Transportation and Infrastructure Committee told National Conference attendees that the Nation falls short in investing in its water resources. Water infrastructure is critical to convey water and to move cargo on rivers from towns and farms to markets and back to communities to sustain economic development. It protects people and property from devastating floods and pools water for multiple uses. It generates hydroelectricity for homes, businesses, schools and other institutions. It provides natural buffers and wetlands to sustain ecosystems, and it provides a venue for recreation. It removes or stores water for drinking and other uses and treats and moves/removes wastewater and stormwater.

Investment in water infrastructure is needed. Much of the Federal water infrastructure in place is nearing the end of its planned design life and too often breaks down from under-maintenance or simple wear and tear. The American Society of Civil Engineers consistently rates the Nation's infrastructure as a *D*, near a failing grade. Failing dams and septic systems are problematic. Not all levees are built or maintained to the same standard, which increases risks of failure. There have been dam and levee breaks, most notably in New Orleans given the force of Hurricane Katrina. Dams that are not up to current safety codes necessitate lower pool elevations and water release restrictions, and in certain situations mining is aggravating the problem. Irrigation systems on Indian reservations need to be rehabilitated, and Native American tribes often have an ability-to-pay issue. Municipal water systems are not sufficient in growing metropolises. Wastewater treatment facilities and stormwater management strategies are inadequate but combined sewer overflows complicate achieving water quality goals. New needs are emerging; current infrastructure cannot meet emerging needs. Some infrastructure is not performing as designed because invasive species (e.g., zebra mussels) are clogging intake valves. Sedimentation in reservoirs and its impact in reducing water storage capacity is a concern.

Shrinking surface waters from droughts and urbanization/ population growth increasingly tap groundwaters and testify to the need for new water supply infrastructure and water treatment plants and increased aquifer storage. States desire routine maintenance, removal of outdated infrastructure that no longer serves a useful purpose, upgraded infrastructure to meet changing conditions and new infrastructure to meet emerging needs.

The Congressional Research Service says a renewed focus on funding is coming from the financial requirements of meeting regulatory requirements, failing infrastructure, costs to protect and secure critical infrastructure, emerging problems that are not being met by existing infrastructure and the stimulus funds intended to reverse the current economic downturn. The costs of funding public infrastructure are high; EPA estimated in 2007 that \$334.8 billion was needed just to improve drinking water infrastructure over the next 20 years to comply with the Safe Drinking Water Act.¹² The Water Infrastructure Network of state, municipal, environmental, professional and labor groups, the H₂O Coalition of Associations for water companies, water and wastewater equipment manufacturers, and the National Council of Public-Private Partnerships identified an annual gap of \$24.7 billion for municipal wastewater and drinking water infrastructure, \$940 billion for improvements and new systems and over \$1 trillion for water and wastewater. The Congressional Budget Office estimated the costs at between \$25.6 to \$41.0 billion for water and wastewater combined (2001 dollars). A 2002 gap analysis by EPA predicted an average annual cost increase of 2.8 percent to 85.8 percent for capital investment and operations and maintenance combined for the years 2000 to 2019. These costs are just for this type of water infrastructure and not the full spectrum of water-related infrastructure. Unlike highway and aviation infrastructure, most water infrastructure does not enjoy long-term trust fund revenues, which may be why the notion of an infrastructure bank, seeded by Federal funds and long-term bonds, is gaining interest.



The need for funding to meet a variety of state water needs was highlighted as the most critical need during this initiative. Participants seek a streamlined funding mechanism and reliable funding stream to counteract trends toward an ad hoc, project-centric, year-by-year approach to funding water needs today. State agency representatives also called for more joint state-

¹²See <http://www.epa.gov/safewater/needssurvey/index.html>

STATES SEEK INVESTMENTS IN INFRASTRUCTURE

In the Western Region, California reports needing funds to rehabilitate and fortify levees in the Central Valley so as to reduce risks and to develop additional water supply sources. The state desires to renovate drinking water facilities. Kansas is challenged by sedimentation in Corps reservoirs and degradation of channels in the Missouri River and would like to conduct a comprehensive assessment of existing flood control infrastructure and current storage capacity. Washington desires new infrastructure to meet growing municipal and agriculture demands.

In the Central Region, Kentucky is interested in exploring alternative financing approaches to fund infrastructure systems and would like at least \$8.2 billion to expand, upgrade and replace public water supply infrastructure to meet requirements of the Safe Drinking Water Act and \$5 billion to address aging infrastructure needs, especially to treat sewage. Missouri expressed concern about its aging public water supply systems (especially small public water supply systems), abandoned wells and coal mines, and the inadequate state of private water wells. Small communities are having difficulty affording upgrades to their water supply infrastructure. Mississippi desires to create an infrastructure backbone at a regional level rather than to rehabilitate many local systems, beginning with a pre-Katrina inventory of infrastructure conditions for communities.

In the Eastern Region, the District of Columbia wants to replace lead pipes in its water supply distribution system. New Jersey desires wastewater treatment plants. North Carolina wants dredging and harbor restoration.

Federal budgets to enable joint projects and initiatives for water resources within watersheds and river systems.

Participants in this initiative extolled moving away from crisis-driven funding toward deliberate investment within a watershed context. A comprehensive water resources investment strategy is needed for research and development of models and technology and data collection and assessment. Also, Congressional support is needed for legislation to ensure reliable funding streams for the full life-cycle of a project, so consultation with Congressional members and their staff is desirable. In the meantime, better management and efficiency improvements may prove fruitful in getting more from available funding. The Congressional Research Service concluded that a watershed-based water resources management approach may help because it favors looking more broadly at water resources in a coordinated way to ensure that actions achieve the greatest benefit. Moreover, green infrastructure may add value; EPA's 319 program, which provides estimates of nonpoint source reduction every few years, may help in this regard.

The American Recovery and Reinvestment Act of 2009 (February 17, 2009) has allocated emergency supplemental appropriations for Fiscal Year 2009 and 2010 to spur the economy and generate job growth, including improvements to water infrastructure. There are concerns, however, as to how these Recovery funds will influence decisions on regular appropriations bills beyond Fiscal Year 2009 for these agencies and cost-sharing partners. Unless project assistance is provided as a grant, communities and project sponsors will need to come up with matching funds—a challenge in the current economic environment. States also wonder how they will continue funding once the Recovery Act expires. Their preference is to receive Federal grants with minimal administrative burden. Not all Federal agencies provide grants. A follow-on effort to this assessment of needs should analyze how states currently can obtain Federal funding to address specific types of needs. Continued dialogue, study and analysis should lead to identification of legitimate creative financing means. Legislative changes may be required to change funding mechanisms; this will require more study and Congressional approval. For now, steps can be taken to improve the efficiency and effectiveness of current arrangements.

Suggested Actions:

1. Develop a comprehensive water resources investment strategy that shifts investment in water resources solutions

away from crisis-driven funding toward integrated water resources management. Note that California requires any new projects to show that they are part of a regional plan before receiving funds. The strategy should not put small states at a disadvantage. Developing a satisfactory funding recommendation will require more study and input from key stakeholders.

2. Document and summarize current Federal funding approaches and authorities that can be used to support states' or interstate water resources management.
3. Fully utilize available funding mechanisms for regional or watershed-scale work, e.g., WRDA Section 22 *Planning Assistance to States*, Section 729(b) for watershed-scale assessments; the 219 program for regional environmental infrastructure; Section 216(5x) for reallocation of water at Federal reservoirs; and Sections 205(j) and 303(e) of the Clean Water Act 604(b) for planning purposes.
4. Advocate for and explore more innovative and collaborative options for funding public water infrastructure, working with public-private partnerships, coalition groups, and providing cost-sharing incentives. For example:
 - to develop, apply and share innovative funding mechanisms, including assessment tools, sophisticated models/processes for allocation of costs and benefits, and examine the impact of tax policies on water projects.
5. Prioritize funding needs within Federal agencies with the aid of decision support models/tools with explicit criteria to assist in prioritizing infrastructure maintenance needs and new construction.
 - a. Develop an inventory of asset management programs across Federal agencies; augment it with state data and prioritized infrastructure based on condition assessments.
6. Find or sustain funding for critical programs and strategic opportunities that reflect collaboration for sustainable outcomes and increased information sharing (e.g., USGS National Streamflow Information Program, LIDAR technology to assess total maximum daily loads [TMDLs], multi-objective and multipurpose studies and projects, USGS National Water Census to provide a current baseline of water availability and use throughout the Nation).





7. Promote legislation that fully funds a project throughout a project's lifecycle of planning, design, construction, and operation and maintenance.¹³ Require proposed projects to justify their relevance in a watershed context and to have an *Operational Plan* for project approval.
8. Promote legislation to change the cost-share formula to incentivize good planning and IWRM using a watershed-based approach.
9. Work with the Office of Management and Budget to explore and develop comprehensive systems-based water resources budgets for clusters of projects.
10. Explore ways to leverage Federal funding to enhance states' implementation of their state water plans based on the states having a comprehensive watershed/basin-scale plan that puts projects in the context of regional water system needs and ongoing activities.

4.6 Managing Extreme Events



Recommendation: Increase the ability to anticipate risks and manage emergency and evolving natural or man-made disasters, especially as related to water resources.

It is an imperative for the Federal, state, and local governments to be prepared to thwart or respond effectively to extreme events, whether they are natural or man-made disasters. Extreme events seem to be growing in frequency and severity. The September 2009 flooding in Atlanta, **Georgia**, where more than 20 inches of rain dropped in torrents in a short period of time, swept victims' cars into rain-swollen creeks and turned living rooms into muddy fields. **South Dakota** is chronically besieged by floods in the Red River, wildfires, severe winter storms, landslides and mudslides. **California** similarly sees mudslides becoming more severe given the loss of vegetation from wildfires whose season has become prolonged. Buoyed by an enormous winter snowfall that melted and drove river levels to record highs, severe weather and extreme floods nearly caused the banks of the Red River of the North in **North Dakota** and **Minnesota** to overflow in late March 2009; in fact, a portion of the floodwall broke and submerged a school campus

¹³This stipulation currently applies to the U.S. Corps of Engineers projects but may apply to other Federal agencies under the revised Principles and Guidelines for project formulation/justification. It does not apply to USEPA State Revolving Funds, which do not, and likely will not, provide for operations and maintenance.



in Fargo, **North Dakota**. The threat was worsened by a sheet of ice that moved slowly toward Oslo, **Minnesota**, creating a major jam on the river whose waters already were above flood stage.

Climate change is a key variable in creating extreme conditions. In 2007 the Intergovernmental Panel on Climate Change (ICPP) released its fourth assessment, *Climate Change 2007*. The report details how climate change is unequivocal and is observed as increases in average air and ocean temperatures globally, widespread melting of snow and ice, sea level rise, precipitation change and extreme events (presumed to be caused by greenhouse gasses). Climate change is impacting ecosystems, water resources, food security, settlements, society and human health, and it is making the American physical and social structures more fragile. Changes in marine and freshwater biological systems are correlated with rising water temperatures and related changes in ice cover, salinity, oxygen levels and circulation, which is causing changes in algal, plankton, and fish abundance and migration in oceans, lakes and rivers. Sea level rise and human development have contributed to the loss of coastal wetlands and mangroves and increased damage from coastal flooding. The U.S. Climate Change Research Program notes projected increases in heavy downpours; lengthened growing seasons; alterations in river flows; threats to crops and livestock from increased heat, pests, water stress, diseases and weather extremes; and adverse impacts to human health from heat stress, waterborne diseases, poor air quality and diseases transmitted by insects and rodents.

Potential climate changes in the Central Great Plains Region (**Colorado, Kansas, Wyoming and Nebraska**) affect winter snowfall, growing seasonal rainfall amounts and intensities, minimum winter temperatures and average summer temperatures. Average temperatures in the Upper **Great Lakes** region are expected to increase by 2 to 4° C while precipitation could increase by 25 percent by the end of this century. Increased temperatures are blamed for a drop in water levels on Lakes Huron, Erie and Michigan, which concerns commercial shippers, hydroelectric companies and recreational boaters, raising serious concerns for ecosystems and the economy. Crops can mature too quickly in warmer climates. Global warming is leading to a hotter and drier summer season in the Western Region of the U.S. and a parched landscape and less robust Colorado River, which serves the needs of 27 million people for agricultural, municipal, and commercial and residential use. Less runoff from decreasing snowpacks and less rain suggest that the Colorado River—the lifeline of the

REFLECTIONS ON CLIMATE CHANGE

The Intergovernmental Panel on Climate Change notes that the Northern Hemisphere snow cover and sea ice are decreasing and freezing seasons are becoming shorter, sea ice is becoming thinner, and glacier melt and permafrost are decreasing. At the same time, soil temperatures are increasing. Snow cover area is expected to contract while heat extremes, heat waves and heavy precipitation events will become more frequent, typhoons and hurricanes will become more intense with larger winds and heavier precipitation in the 21st Century, and sea level could rise 7 mm in the future.

Weather extremes are being documented. The National Climatic Data Center characterized the 2008 Atlantic hurricane season as the fourth busiest year since 1944 and the only year on record in which a major hurricane existed in every month from July through November in the North Atlantic.



Southwest through **Arizona, California, Colorado, Nevada, New Mexico, Utah** and **Wyoming** and into Mexico—will not be able to allocate water to meet consumption needs for homes, farms and businesses by 2050 if climate change warnings prove true. Hoover Dam’s Lake Mead reservoir could run dry by 2021. Sea level rise and storm surges along the Eastern and Gulf coasts increase the risk of erosion and flooding. Contamination from animal wastes following storms becomes a problem. Flooding has negative implications for the region’s fisheries and coastal ecosystems. Farmland and wetlands are lost, which means reduced habitat for species and shorebirds and declining biodiversity.

Many believe that possessing or having access to timely, accurate and complete information is the best form of preparedness. State agency representatives universally expressed their desire for information about what might happen as a result of climate change and how to prevent it or mitigate its adverse effects. This concern was validated by the Federal agency representatives from the Department of Interior and its representatives from the Bureau of Reclamation, USGS, Fish and Wildlife Service and Bureau of Land Management; EPA; NOAA; FEMA; USDA Headquarters and its U.S. Forest Service and Natural Resources Conservation Service; the Department of Defense; and the Council on Environmental Quality.

States consistently seek reliable future water sources, so droughts are especially problematic. The U.S. Drought Monitor¹⁴ shows, as of September 29, 2009, that **Texas** and **Wisconsin** are suffering the most extreme or exceptional droughts, with **California, Nevada** and **Arizona** suffering severe droughts as well. **Washington, Oregon, Idaho, Montana, Utah, Colorado** and **New Mexico** have not escaped droughts.

Droughts precipitate much emergency planning and overall water resources planning especially when the thought of the water spigot running dry becomes frightening. As populations grow and move, development ensues but the water infrastructure does not necessarily follow.

In response to the 1998 National Drought Policy Act (Public Law 105-199), the National Drought Policy Commission (NDPC) (with a range of representatives from Federal, state, public and private interests) submitted the report *Preparing for Drought in*

¹⁴The U.S. Drought Monitor is a partnership among the Department of Agriculture; Department of Commerce; University of Nebraska’s National Drought Mitigation Center; USGS; USDA-Natural Resource Conservation Service’s National Water and Climate Center; NOAA’s Climate Diagnostics Center, National Weather Service, and National Weather Service Hydrology; regional climate centers; and state climatologists.



the 21st Century in May 2000. The report presented “the basis for national drought policy and calls for commitment and resolve in providing sufficient resources to achieve policy goals.”

The Commission’s report issued a policy statement “that national drought policy should use the resources of the Federal government to support but not supplant nor interfere with state, tribal, regional, local, and individual efforts to reduce drought impacts.” Furthermore, the Commission established guiding principles of national drought policy:

- Favor preparedness over insurance, insurance over relief and incentives over regulation.
- Set research priorities based on the potential of the research results to reduce drought impacts.
- Coordinate the delivery of Federal services through cooperation and collaboration with nonfederal entities.

One of the recommendations was that Congress pass a *National Drought Preparedness Act* to establish a nonfederal/Federal partnership “...to ensure that the goals of the national drought policy are achieved.” Although legislation was introduced to Congress in 2001, 2003 and 2005 following the recommendations of the NDPC, these initiatives were not enacted in their entirety. What did pass was the National Integrated Drought Information System Act of 2006 (Public Law 109-430), which established a National Drought Information System within NOAA “to improve drought monitoring and forecasting capabilities.”

New Orleans, **Louisiana**, exemplifies the danger of not being adequately prepared for potential disasters. Preparedness planning using alternative scenarios suggested that the chance of a Category 5 hurricane directly striking New Orleans was a one-in-500 year event, yet Hurricane Katrina struck and created the worst engineering disaster in U.S. history. Evacuation plans proved inadequate, and blame for the lack of preparedness was spread around all levels of government. For five days civil order broke down, infrastructure failed, and 80 percent of the city flooded without significant Federal response. There were serious communications failures (telephones and Internet service went out), damage to buildings and roads (bridges collapsed and the airport closed), levee failures putting the city under water for days and 1,464 people died. Violence ensued from the breakdown of transportation, communication, and the fact that police and civil entities were overwhelmed.

EXAMPLES OF INTEGRATED WATER AND EMERGENCY MANAGEMENT PLANNING

Rhode Island’s Emergency Management Agency incorporates natural hazard mitigation and storm and flood response planning in emergency response planning.

Virginia and Connecticut include drought management and emergency management planning in their statewide planning.



Certainly in the aftermath of Hurricane Katrina and even before, states have engaged in emergency management activities, especially drought planning, to ensure they have sufficient water supply sources for the future and to conserve current sources. Katrina changed the way the Federal government addresses its preparedness and water infrastructure planning and raised awareness that the infrastructure systems were not developed with a systems view sufficient to provide a high level of protection. Most often emergency planning is engaged in by departments or agencies separate from water resources planning such that emergency/drought management and hazard mitigation plans are not necessarily integrated into state water plans. A few states are exceptions.

Chairman James Oberstar of the U.S. House Transportation and Infrastructure Authorizing Committee noted that we tend to only think about water when there are floods and droughts. Although we know that droughts will occur, we often do not develop long-term drought plans. We have paid \$31 billion in flood insurance since 1978, but drought management plans tend to be shelved when the rains finally come. Then we get worried when a hurricane washes an area away. We use our water supplies as if they will last forever but once we take water from groundwater aquifers, it will take years to replenish them from snowpacks. Scientists predict a 20 percent reduction in snowpacks (snowmelt) by the end of the century. This *seeing* is characteristic of our water planning, Chairman Oberstar said.

Sharing/pooling information about trends, best practices, external threats and lessons learned from responding to extreme events is deemed invaluable. At the National Conference, Ms. Deborah Ingram, Acting Administrator for Mitigation at FEMA, called for collaborative planning to ensure readiness and responsiveness. FEMA's mission is to ensure adequate preparation, mitigation, response and recovery from floods and other disasters—increasingly through flood risk damage reduction strategies and grants in concert with other Federal agencies and state, local and tribal governments. More coordinated mitigation and response planning is desirable. FEMA is trying to be proactive and build relationships with local personnel ahead of crises. FEMA is partnering with the Corps to educate people about risks and the probability of hazards so as to improve individuals' decision making about where they choose to live. The agency is initiating a risk-based map modernization program to assist communities to be more aware of flood risks and to better prepare and respond to severe flooding. Tribes acknowledge the value of including information about Indian

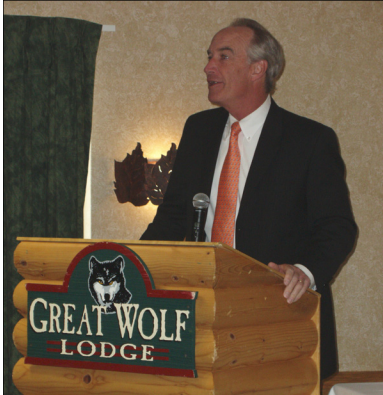
reservations on these maps. FEMA is collaborating with NOAA and the USGS to bring in Earthlink data to assess hazards at multiple levels and their impacts on water resources. The USGS Circular 1331 on climate change, produced by NOAA, the Corps and the Bureau of Reclamation, will facilitate informing organizations inside and outside government about the potential impacts of climate change.

Suggested Actions:

1. Collect, compile, analyze and share information about states' drought, flood mitigation and general emergency planning to summarize their state of readiness and the adequacy and effectiveness of response and contingency plans in specific river basins, watersheds, and coastal zones or other disaster prone areas. Compile this information in a database that can be fed into the *Federal Support Toolbox*. This information, as well as tools that support integrating water resources, land and hazard mitigation management within a proactive framework, can enable recovery to be responsive to future needs and expected probabilities.
2. Build climate change assumptions, data and risk-management methodologies into water resources planning models based on the latest research.
3. Coalesce and widely publish condition assessments of water infrastructure.
4. Provide technical planning assistance to states to help them develop comprehensive state water plans that integrate disaster/emergency/drought management plans and water resources plans in a single document or aligned documents.
5. Support FEMA in updating flood risk maps with relevant information across Federal agencies and promote sharing with states widely. Seek to include tribal information on these maps.
6. Expand the *Silver Jacket* interagency communications team to all 50 states so as to have a well-trained and proactive Federal-state-local team on the ground that coordinates a comprehensive flood risk management program.



4.7 Technology Transfer and Knowledge Capacity Building



Recommendation: Base the development of water resources plans and decision making upon good science and the sharing of information and technology. Increase scientific and management knowledge and technology/technological capabilities at all levels of government.

Data goes stale and decision-making is too often based on outdated information. Farmers and city planners need current and complete information. Government at all levels needs to make data dissemination more streamlined. Decision support systems require information in which people have confidence. Data and information are the foundation for describing, understanding, predicting and making decisions in the field of water resources. When decisions are not grounded in science but rather are politicized, they are skewed, reflect favoritism, and alienate scientific and professional communities of practice, often producing bad decisions that are not likely to have desired effects. Many experts, including the National Academies National Research Council, have long espoused the importance of basing decisions on a solid and rational foundation. Scientific work is difficult and expensive and thus needs to reflect attention to scientific ethics, principles and protocols in order to breed confidence about methods, findings and conclusions. As Ms. Barbara Naramore, Executive Director of the Upper Mississippi River Basin, told attendees at the National Conference:

“We do not need perfect knowledge to take sound action. We need to bring better and more relevant information to decision makers to make better decisions with limited resources. It is our responsibility to help decision makers anticipate needs and take smart action with a wide range of players.”

Mr. Michael Wells, Deputy Director and Chief of Water Resources of Missouri’s Department of Natural Resources, recounted at the Central Region Conference that the Central Region states endorse a systems approach, desire quantitative data and information, call for increased monitoring, and seek technical expertise and Federal funding for locally led and

sustainable projects. Technology has enabled states and interstate organizations to play a critical planning role such that active groups at local watershed levels have been able to assume many of the roles that a centralized Federal capability once played to develop the Nation's water resources.

The development and use of enhanced data, science and technology, and management processes for deepening knowledge and capability about water issues can infuse planning, decision-making and evaluation processes with a solid scientific foundation. The knowledge and wisdom of experienced scientists and technology professionals is deemed invaluable to effective government. Technical assistance, tools, information and funding support to obtain baselines and long-term trends and to assess and monitor resource availability and conditions on a continual basis are of the utmost importance to states. States desire to share findings widely and easily and to translate raw data and analyzed information into knowledge to inform comprehensive planning and astute decision making. Mr. Michael Bogert, former counselor to the U.S. Secretary of the Interior, Dirk Kempthorne, urged the Western Region Conference attendees: "Let's share the data and information we have now!"

Consistent baseline information across Federal programs about flow levels in rivers and streams and minimum levels required to successfully execute diverse water functions is also needed. Continual streamgauge monitoring can provide consistent baseline information important to set minimum flow requirements for diverse water uses and can help address point and nonpoint source pollution, survival of species, the Gulf of Mexico hypoxia problem, timing of flows and flow cycles, sediment impacts along the Louisiana coast, management of nutrients and invasive species in waters, intrusion of saltwater into freshwater supplies, and water supply sources and quality, especially for potable water. Climate change models, risk management methodologies, decision-support systems, and predictive and interactive processes are desired, for example, to develop both site-specific and regional approaches to advance the science of ecological flows. Investment in research and development activities to develop models and technology can facilitate sophisticated analyses and innovative breakthroughs to further understanding of water processes, methodologies and impacts. In reviewing the findings about the Western states for this project, Mr. Duane Smith, Executive Director of the Oklahoma Water Resources Board, highlighted the importance of technically rigorous analyses from rigorous comprehensive data collection for state water planning in the Western Region.

EXAMPLES OF USEFUL MODELS SUPPORTED BY SELECTED STATES AND INTERSTATE ORGANIZATIONS

The U.S. ARMY CORPS OF ENGINEERS *Shared Vision Planning Process* — a collaborative model building process to build consensus about a shared future vision as the context for resolving water resource issues in particular locations— it helps a team model watershed dynamics and has been used for flood control, water supply, water quality and recreational planning. The Corps' Institute for Water Resources (IWR), Hydrologic Engineering Center (HEC) and Engineering Research and Development Center (ERDC) provide a variety of hydrologic planning models and systems-wide analytic tools.

MASSACHUSETTS uses the Ecological Limits of Hydrologic Alteration (ELOHA) model, the Ecological Sustainable Water Management (E-SWM) Model and the Indices of Biotic Indicators.

The DELAWARE RIVER BASIN COMMISSION has a Flexible Flow Management Model.

The MINNESOTA Groundwater Work Group developed the METRO groundwater model as a predictive tool for sustainable water supply management in collaboration with the Departments of Natural Resources and Health, the Minnesota Geological Survey, counties and cities, the Metropolitan Council and the USGS.

FEDERAL WATER AND LAND MANAGEMENT AGENCIES

- Army Corps of Engineers
- Bureau of the Census
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Reclamation
- Council on Environmental Quality
- Department of Homeland Security offices
- Economic Development Administration
- Environmental Protection Agency
- Federal Emergency Management Agency
- Fish and Wildlife Service
- Food and Drug Administration
- Forest Service
- National Oceanic and Atmospheric Administration
- National Park Service
- National Institute of Environmental Health Sciences
- Natural Resources Conservation Service
- National Science Foundation
- National Weather Service
- Office of Housing and Urban Development
- Rural Utilities Service
- Small Business Administration
- State Department's International Boundary and Water Commission
- Tennessee Valley Authority
- U.S. Geological Survey

In summarizing the *Federal Agency Assessment* undertaken as part of this initiative (see list of agencies to the left, not all of which participated in this initiative) at the National Conference, Dr. Matthew Larsen, Associate Director for Water at the U.S. Geological Survey, highlighted examples of the many programs, models and databases which the Federal agencies can offer states in their water planning to provide hydrologic data/information for a watershed-scale assessment of water availability and quality in interstate waters. He suggested that a means to move forward is through the National Science and Technology Council's Subcommittee on Water Availability and Quality (SWAQ), a group that has fostered collaboration toward IWRM through information exchanges; however, this group lacks governance authority.

The Federal agencies have much to offer for technology transfer and knowledge capacity building. In particular, the Bureau of Land Management (BLM) and Reclamation (BOR), the Environmental Protection Agency (EPA), the Federal Emergency Management Agency (FEMA), the National Park Service (NPS), the Natural Resources Conservation Service (NRCS), Fish and Wildlife Service (FWS), the Forest Service (FS), the National Oceanic & Atmospheric Administration (NOAA), the Tennessee Valley Authority (TVA), the Corps and the U.S. Geologic Survey (USGS) reflect a myriad of capabilities or functions and programs for land resource management, water infrastructure and development, environmental protection, disaster preparation and response, and science and information. Federal resource agencies develop and maintain analytic methods and models for understanding, estimating, forecasting and predicting water resources parameters; they develop and maintain databases and geospatial information systems (GIS) of water resources information.

A real problem in sharing information, tools and models is the fragmentation of funding and responsibilities of Federal agencies with water resource functions. The budgets of Federal agencies are managed by 14 different House and Senate Authorizing and Appropriation Committees (and related subcommittees) in support of 117 Federal water-related programs.¹⁵ This fragmentation makes true integration difficult. Nonetheless, there are initiatives upon which to build. NOAA's Hydrology Program has an incipient effort to produce

¹⁵Federal agencies have at least 117 programs that address multipurpose management; climate change; water supply; water quality; growth and development impacts; infrastructure; energy development impacts through planning; data collections and management; modeling; regulatory; project development; operation and maintenance; technical assistance; water education; mitigation; research and development; and demonstration projects and services involving water quality, water supply, climate change, navigation, hydropower, natural hazards management, integrated water resources management and recreation.



the Integrated Water Resources Science and Services (IWRSS) database focused on *People, Technology and Science* for summit-to-sea modeling and predictions, including physical and social strategies. The USGS National Water Resources Information System intends to provide high-resolution water resources information and forecasts from summit to sea by integrating information, increasing information accuracy and timeliness, and simplifying access to this information. A role the Federal government can play is to collect and manage data and to provide consolidated databases to the public and private sectors.

The *Federal Agency Assessment* also supported development of the *Federal Support Toolbox* containing key information (authorities, policies, programs, data and databases, best practices, lessons learned, tools and methods) made accessible on the internet via a common data portal. Dr. Carol Couch, director of the Environmental Protection Division in the Georgia Department of Natural Resources, told the National Conference attendees that “The states are definite customers for a *Federal Support Toolbox* of science-based tools.” The Federal resources agencies NOAA, USGS and the Corps have initiated building this support toolbox, which will provide a common portal of data and information about water and related resources. Having access to a GIS-based map that catalogs and provides information electronically for specific river basins, watersheds and coastal zones can deepen knowledge and understanding and provide a vehicle to facilitate partnering, planning and adaptive management. The *Federal Support Toolbox* can provide updated and complete databases and the latest tools and models, foster innovation and integration, and facilitate wider access to data and information needed to plan, manage and develop water policy. Additionally, technology transfer and public information and education activities of Federal laboratories can test and apply scientific developments. Enhanced collaboration, networking and information sharing across Federal laboratories and science centers can promote technology transfer and integration of scientific findings and technology. Promulgation of data and information through appropriate data portals can transfer information to an audience beyond the Federal government.

Data and information that are not shared have limited effects. Technology that is not promulgated has limited impact. A concerted effort is needed to share data and scientific information about common river systems and watersheds and to transfer scientific findings and technology to a wide audience—including the general public and decision-makers.

“The Federal water agencies can serve many roles by integrating and improving access to information, enabling cooperative workflow and establishing a common picture to support critical decision-making.”

Ms. Mary M. Glackin
Deputy Under Secretary for
Oceans & Atmosphere,
National Oceans &
Atmospheric Administration
National Collaborative Water
Resources Conference
Washington, D.C.
August 2009

FEDERAL AGENCIES HAVE MODELS AND DATA TO SHARE

Models that the Federal government can share include hydraulic flow models, run-off and sedimentation models, water quality models, climate change models, groundwater models, dam safety models, shared vision planning models, water supply forecasting models and coastal decision-making models. Examples include the Drought Monitor; national environmental satellite data and information service (SEEDIS); STORET; Hydromet monitoring stations; national water information system web (NWISweb); Stream Stats; the USGS National Streamflow Information Program; NRCS's SNOTEL Program (automated SNOpack TELEmetry system to collect snowpack and related climatic data for water supply forecasts and water resources planning); NOAA's precipitation data; the Bureau of Reclamation's agricultural and meteorological and evapotranspiration (ET) data under the AGRIMET (AGRIcultural and METeorological) Program to foster water and energy conservation; and water quality data from EPA's National Pollutant Discharge Elimination System permit system to control water pollution by regulating point sources that discharge pollutants into U.S. waters.

Suggested Actions:

1. Improve data collection, sharing and use, and development and transfer of science, management and technology to obtain baseline data, to deepen knowledge about water issues and needs, and to infuse planning, decision-making and evaluation processes with a scientific foundation.
2. Mine and summarize the data and information collected for this assessment to share with states, across Federal agencies, with tribes and interstate organizations, nongovernmental entities and with others as appropriate. A database of this information (specifying tools, models, databases for particular applications and water uses/ functions) organized by states and Federal agencies will facilitate follow-up probing.
3. Formalize, augment and inform standing groups already dedicated to sharing and promulgating scientific information related to integrated water resources management, e.g., NOAA's IWRSS working group, SWAQ, ACWI and others.
4. Develop an interagency *Federal Support Toolbox* in support of technology transfer and knowledge capacity building.
 - a. Develop formal partnerships (MOUs) with other agencies—especially among the Corps, USGS and NOAA—to develop the *Federal Support Toolbox*.
 - b. Establish an executive interagency governance structure to support the *Federal Support Toolbox*.
 - i. Document cross-agency funding requirements and a programming strategy.
 - ii. Explore cross-agency funding for the *Federal Support Toolbox*, including discussions with relevant Congressional committees and OMB.
 - c. Explore opportunities and develop a plan for data/ information sharing and technology transfer, and, if appropriate, codify this in a plan that specifies who will do what when to share and transfer specific information.

- d. Share the GIS-based management tools for key river basins with others in the spirit of technology transfer.
5. Link Federal databases as appropriate, e.g., the National Drought Information System and the National Streamflow Information Program and include these databases in the *Federal Support Toolbox*.
6. Support efforts to seek, adopt/adapt, and develop holistic, multicriteria hydrologic and climate, models that connect and provide information at multiple geographic scales, e.g., energy and water. Summarize the existing Federal agency models. Develop and apply simulation models to describe complex processes. Apply consensus-building processes, scenario analyses and simulation models.
7. Promote policies and accountability mechanisms that ensure that decisions are based on independent and science-based technical reviews and that those policies reflect sound science.

“Stationarity’ is a dead concept. Water resources planning must consider change, especially climate change, in a dynamic model that builds in system flexibility, uncertainty, robust alternatives and adaptive management. Collaboration on research and monitoring are needed.”

Mr. Ward Staubitz
Coordinator for the U.S.
Geological Survey’s
Cooperative Water Program
Eastern Region, Collaborative
Water Resources
Conference
Orlando, Florida
February 2009

4.8 Enhanced Water Resources Leadership



Recommendation: Build and reinforce leadership/stewardship for responsible water management among water professionals across federal, tribal, interstate, and state agencies and at large.

The roles and responsibilities of those involved in water resources management are diverse and important and serve a leadership function. Decisions can be enhanced if policymakers better appreciate the seriousness of situations, the options available to them to resolve them and the quality of solutions. Leadership is critical to building commitment to responsible stewardship of precious natural resources. Many diverse groups have played and can play an important role in promoting leadership for solutions that might be developed and implemented to sustain critical economic, environmental and social/human resources.

Leadership is needed to link and leverage the myriad Federal programs and initiatives related to resource management, especially water resources management. Leadership means creating, collecting, and sharing data and information and



turning data into knowledge through effective partnerships and collaboration. While states have primary responsibility for water resources planning, they desire technical and financial assistance from the Federal government to put their plans into action. A primary avenue for Federal leadership is to provide the research and development for information and technology resources that states and others can avail in their water resources planning.

There is a need to close information gaps and to build capabilities; this is a leadership role that many can step up to perform. The Federal agencies can exercise leadership by providing information about emerging issues. The NRCS Conservation Technical Assistance program, the USACE Planning Assistance to States program, the Bureau of Reclamation Basin Studies Program, and the USGS National Streamflow Information Program are solid efforts to build on.

Partnerships support leadership by furnishing, pooling and leveraging resources and providing baseline assessments of regional needs. The river basin commissions already play an important leadership role in analyzing information in a systems context through integrated frameworks. They bring key stakeholders together, facilitate conflict resolution, and inform policy making and decision making with scientific findings and well-reasoned arguments. Federal leadership is to ensure that inter-states and regional associations can continue to play this role.

Native American Tribes share resources with states and deserve a leadership role in conserving their resources. Tribal claims on land and water rights must be resolved to enable them to play an integral role as a full partner in planning and providing their cultural perspective in water resources plans and solutions.

Nongovernment organizations already play a key leadership role in raising awareness and commitment to responsible water resources stewardship and problem solving.

Suggested Actions:

1. Address governance issues to promote more effective and integrated water resources management and collaborative leadership for water resources stewardship and sustainability.
 - a. The Federal Principals Group for a Sustainable Water Future, if established, could serve as a steering group and endorse an integrated horizontal committee of key representatives across the Federal agencies.

2. Review, revise and apply Federal authorities to align Federal capability for collaborative water resources planning and management with states, tribes, interstate organizations and nongovernmental entities.
3. Study opportunities and mechanisms to engage the private sector in sustainable water resources management and issue a recommendation.
4. Work with Native American tribes to raise water resources awareness and conservation on Native American reservations and to integrate their needs and interests better in state and regional water resources plans.
5. Mine the data/information collected through this assessment for further use in developing the *Implementation Plan*.
6. Clarify and reinforce the roles of water resources stakeholders in more effective water resources planning and management (eg., Roles below).



Additional Recommended Actions Based on Leadership Role

CONGRESS

1. Consider legislation or strengthen authorities that broaden Federal agencies' ability to perform integrated water resources management and to support states more fully in developing comprehensive state water plans.
2. Develop a mechanism or organizational structure that promotes alignment and integration across the Federal agencies to overcome the fragmentation, conflicts, voids and inconsistencies that stymie concerted action toward IWRM for sustainable outcomes.
3. Sustain the ability of the river basin commissions to play a major role in promoting integrated water resources management, including regional assessments, public education, and consensus building or conflict resolution.
4. Ensure that programs that foster integrated water resources management (e.g., USGS' National Water Census, Cooperative Water Program and National Streamflow Information Program and watershed/system studies) have sustained funding.
5. Promote life-cycle funding for water infrastructure at all government levels.



COUNCIL ON ENVIRONMENTAL QUALITY (CEQ)

1. Coordinate across Federal agencies to better balance environmental, economic, and human/social/quality of life objectives and programs, and pursue aligned initiatives through an interagency working group, e.g., a new Federal Principals Group for a Sustainable Water Future.
2. Review, revitalize or revise the 2000 Executive Order, *Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management* to enable interagency work toward IWRM.¹⁶
3. Ensure that the revised *Principles and Guidelines* reflects a systems watershed approach that reinforces integrated water resources management for multiple outcomes.

OFFICE OF MANAGEMENT AND BUDGET

1. Explore joint interagency budgeting for common aims toward more integrated water resources management.
2. Sponsor studies on new funding mechanisms for integrated water resources management.
3. Ensure that programs that foster integrated water resources management (e.g., USGS National Water Census and National Streamflow Information Program) and watershed/system studies have sustained funding.
4. Support the integration of water and emergency management plans to include contingencies for climate change impacts on water resources and its infrastructure.
5. Embrace a change in cost-sharing formulas to encourage state participation in integrated water resources plans.
6. Support a system-based budgeting process to allow holistic assessment of project benefits/costs and the development of comprehensive solutions to water resources problems.

FEDERAL AGENCIES

1. Adopt a reinforced role as facilitator and integrator for integrated water resources management.
2. The Corps should continue to be a convener and facilitator, i.e.:

¹⁶The EO tasked the Departments of Agriculture, Commerce, Defense, Energy and the Interior; the Environmental Protection Agency; the Tennessee Valley Authority; and the Army Corps of Engineers to support a unified Federal team to work toward shared aims in support of IWRM.



- a. Create an informal Federal Principals Group to coordinate development of U.S. water policy.
 - b. Establish a collaborative National Water Team comprised of Federal agency, interstate, tribal, state and nongovernmental representatives.
 - c. Draft an Implementation Plan in collaboration with a National Water Team and in the implementation of recommendations from this assessment.
3. Promote understanding about integrated water resources management. Develop communications strategies and key themes about IWRM.
 4. Promulgate policies, concepts, definitions, best practices and case examples that reflect and support IWRM as part of a wide educational effort.
 5. Actively participate in interagency working groups to focus and leverage high-impact initiatives for integrated water resources management. Explore specific lead agency responsibilities for particular recommendations proffered in this report.
 6. Given appropriate mission and contributions, other Federal agencies should partners with The Corps, USGS and NOAA on the building of the Federal Support Toolbox based on the IWRSS framework and data that can be shared nationwide. Engage Federal laboratories as appropriate in identifying data, information, tools and models for the *Toolbox*.
 7. Work with Native American tribes to raise water resources awareness and conservation on Native American reservations and to integrate their needs and interests in water resources plans.
 8. Align authorities and resources to participate collaboratively in programs and on developing and managing projects in major water systems as learning laboratories for integrated water resources management, building on current efforts and successes (e.g., the Columbia River, the Colorado River, the Sacramento-San Joaquin River Basin, the Great Lakes, the Ohio River Basin, the Mississippi River, the Everglades, the Gulf of Mexico, etc.).
 9. Identify and catalogue opportunities to integrate ongoing water and related resources efforts of Federal agencies within each water system.





10. Leverage GIS-based technologies of Federal agencies. For each major water system, catalog current activities on GIS-based maps to engage discussion with local, state and regional officials for future plans and opportunities to develop or enhance GIS-based maps, especially at a regional level.
11. Continue initiatives directed at greater integrated water resources management, e.g., the National Water Census.
12. Promote science and technology development, sharing and transfer.
13. Review summary reports that propose recommendations for water resources management in the 21st Century (e.g., the American Society of Civil Engineers' *Report Card for America's Infrastructure*; the Western Governors' Association June 2008 recommendations; AWRA Policy Dialogue recommendations, etc.); add supportive recommendations to the list of proposed actions for the Implementation Plan.
14. Identify conferences, symposia, workshops and meetings, and working groups to leverage or follow on to in order to share information and create opportunities for collaboration.
15. Explore means to foster coordination across Eastern and Central states and nationally, such as an EastFAST and a CentFAST or a NatFAST or others, as appropriate for these regions and nationally.
16. Explore and recommend public-private partnerships, especially at the small watershed or aquifer scale, to further joint efforts toward integrated water resources management in specified river systems/watersheds.
17. Recommend ways to provide technical assistance to states in developing their statewide and regional watershed plans.
18. Identify demonstration IWRM-focused projects in specific watersheds.
19. The Federal water resource agencies should further coordinate and collaborate with the Department of Energy and other related energy agencies and leverage opportunities for further evaluation of a national strategy for addressing the energy-water nexus, particularly with alternative energy sources.
20. Continue the dialogue about how to meet the Nation's water resources needs, especially in support of states, through meetings around the country.



TRIBAL GOVERNMENTS

1. Raise awareness about water issues on Native American reservations.
2. Work with the Federal government, interstate organizations and states to resolve water rights issues.
3. Support efforts to update floodplain maps on reservations.
4. Hold workshops to discuss water issues affecting tribes and Native American reservations.

INTERSTATE ORGANIZATIONS

1. Conduct active outreach and education to raise awareness and promote best practices for responsible stewardship and conservation and integrated water resources management.
2. Conduct studies and research about pressing water issues and share the results widely in support of regional and cross-boundary water and related resources planning, especially to obtain and update baseline information about water resources conditions, use and needs.
3. Foster collaboration and consensus-building for responsible water resources management, increased conservation and stewardship.
4. Conduct and publish the results of evaluation efforts to provide feedback about the results of interventions in support of water resources management.
5. Promote, reinforce and model integrated water resources management.



STATES

1. Develop statewide comprehensive and integrated water plans as supported by the Governor and Legislature, Federal government and interstate organizations.
2. Collect and catalog regional and river basin case examples for effective and integrated water resources management.
3. Contribute ideas, data and information for the *Federal Support Toolbox*.
4. Develop interstate partnerships.
5. Participate in intergovernmental working groups to help identify sustainable solutions.
6. Conduct demonstration projects to promote integrated water resources management.



LOCALS

1. Foster collaborative planning and management.
2. Implement and demonstrate integrated water resources management or seek further and more balanced objectives and outcomes of water resources interventions.
3. Develop and implement educational outreach and advocacy efforts to raise awareness and understanding about water issues.
4. Identify key water resources issues, challenges, problems and results/benefits of specific interventions.
5. Collect, analyze, and share data and information that supports implementation of water resources plans; contribute case studies (both successes and failures) to promote water resources understanding and knowledge.
6. Coordinate local watershed groups in support of common water resources goals.

NONGOVERNMENT ORGANIZATIONS

1. Engage in meetings and conversations about topical water issues, e.g., the merits of a national water vision.
2. As appropriate, participate in crafting a vision statement and in gaining consensus about it.
3. Build a database of points of contact for partnering on watershed-scale initiatives.
4. Promote education and outreach.
5. Contribute case studies and examples of effective IWRM for the *Federal Support Toolbox*.

The Federal government, tribes, states, interstates, and nongovernment organizations have important roles to play, which can be made even more effective through collaboration or joined roles. Participants in this assessment offered the following role clarification.

TABLE 2: ROLES IN WATER RESOURCES MANAGEMENT

FEDERAL GOVERNMENT

- Set policies and provide guidance for water resources management.
- Fully utilize existing Federal authorities to support effective partnerships for sustainable water resources management.
- Support more reliable and comprehensive data and information collection, more rigorous and robust analysis using GIS-based processes, risk-informed maps, and state-of-the-art science and technology.
- Provide technical assistance for comprehensive and systems-oriented water planning at state, regional and even local levels that attempts to balance competing needs through integrated water resources plans and adaptive management strategies.
- Pay attention to degraded and new infrastructure for water supply, wastewater treatment, flood control, navigation, hydropower, etc.
- Provide funding to maintain programs, protect resources, promote innovation and promote good science.
- Assist in mediating conflicts and disputes.
- Set standards and ensure compliance with regulations.
- Provide oversight.

TRIBAL GOVERNMENTS

- Set policy about resource management on Native American reservations.
- Monitor and practice adaptive management to protect, conserve, and enhance resources and resource situations.
- Develop and implement plans within Indian water rights.
- Participate in information sharing about water resources.
- Inform about unique needs and characteristics.

INTERSTATE ENTITIES

- Synthesize regional needs using a systems framework.
- Facilitate integrated basin planning and coordination.
- Build consensus and engage stakeholders.
- Foster understanding and consensus through education and advocacy.
- Unify member states of compacts and agreements through data sharing and advising.

NONGOVERNMENT ORGANIZATIONS

- Provide technical support.
- Promote education and outreach for awareness and understanding.
- Develop and share models.
- Provide focus, communications and advocacy for action.
- Convene and facilitate meetings and collaborative efforts.
- Advocate for responsible stewardship of natural resources and ecosystem services.

TABLE 2: ROLES IN WATER RESOURCES MANAGEMENT *(continued)*

STATES

- Identify and prioritize water resources needs and develop land, water, and emergency management or hazard mitigation plans to meet these needs.
- Allocate water to meet critical water needs.
- Seek sustainable water supplies as a basic safety net for current and growing populations.
- Improve water quality for confidence about drinking it; bathing in it; swimming in it; fishing in it; boating in it; allowing plants and species to survive in and by it; sustaining agricultural, industrial and municipal livelihoods; and simply finding the joy in water and all it can do for us.
- Ensure consistent and persistent assessment and monitoring.
- Identify and prioritize water resources needs and develop land, water, and emergency management or hazard mitigation plans to meet these needs.
- Allocate water to meet critical water needs.
- Provide funding to maintain programs, protect resources, promote innovation and promote good science.
- Assist in mediating conflicts and disputes.
- Set standards and ensure compliance with regulations.
- Provide oversight.
- Set policies and provide guidance for water resources management.
- Fully utilize existing Federal authorities to support effective partnerships for sustainable water resources planning and management.
- Support more reliable and comprehensive data and information collection, more rigorous and robust analysis using GIS-based processes, risk-informed maps, and state-of-the-art science and technology.
- Seek sustainable water supplies as a basic safety net for current and growing populations.
- Provide technical assistance for comprehensive and systems-oriented water planning at state, regional and even local levels that attempts to balance competing needs through integrated water resources plans and management strategies.
- Attend to degraded and new infrastructure for water supply, wastewater treatment, flood control, navigation, hydropower, etc.

LOCALS

- Implement water plans and decisions.
- Coordinate with state agency programs.
- Comply with Federal and state mandates and regulations.
- Scout and identify water needs at local watershed levels.
- Develop approaches and plans to conserve, protect, and enhance water and related land resources for ecosystem viability.
- Coordinate with local groups for joint aims.
- Collect data; conduct ongoing monitoring of resource conditions, use and availability.

4.9 Communications and Education



Recommendation: Enhance the ability of public officials at all levels and public and private water resources stakeholders to understand and communicate priorities for water resources through awareness-building, formal and informal educational and learning initiatives, and public outreach and communications activities.



The need to raise awareness and better inform students (the next generation of water resource professionals), the general public, stakeholder interest groups, and decision makers to ground water decisions in responsible science and robust understanding was consistently supported by many participants during this initiative. A variety of formal and informal educational activities and outreach are critical to building awareness and commitment and understanding. Many diverse groups have played and can play important roles in grounding understanding in sound science and commonsense solutions. The power of public information and outreach has been demonstrated but can be enhanced. Scientific information can be strengthened.

There are many information gaps that should be closed. Science grounded in more synthesized reporting on water use and progress at multiple scales will help, as will more consistent standards, performance measures, routine assessments (e.g., species inventories to assess biodiversity), reporting and accountability. Participants called for increased information sharing and investment in research to develop tools and comprehensive data and information bases. The Federal government, Tribes and states have much technical information about water and other resources to share. Ways must be found to facilitate and expedite this.

There are abundant local watershed groups that are already working to assess, monitor, report on, advocate for and conduct outreach to sustain resources in and around oceans and coastlines, rivers, streams, lakes, wetlands and the like. These groups are making progress because of visionary leaders and activists who are able to mobilize and focus energy and effort in an aligned direction. They build and breed commitment. These

groups can be better linked and leveraged for more facile and integrated water resources outreach and education.



Nongovernment organizations already play a key leadership role in raising awareness and commitment to protecting water resources and can augment the states' and Federal government's water resources roles. As Mr. Jerry Enzler Executive Director of the National Mississippi River Museum and Aquarium (NMRMA) in Dubuque, Iowa, emphasized at the Central Region Conference, his NGO offers public information and educational programs to reveal information, educational technology, and a powerful network/consortium of 22 leading aquariums, 35 nongovernment organizations and partnerships with Federal entities. This network is dedicated to promoting awareness and understanding about the value of an ecosystem management approach to stewardship of the Mississippi River from Minnesota to the Gulf of Mexico. The educational span of NMRMA engages visitors, teachers, students, farmers, producers, legislators, water professionals and scientists, libraries, interpretive and learning centers and the general public in conserving and restoring the basin through dynamic hands-on/interactive exhibits and programs.¹⁷

Professional associations such as the American Water Resources Association, the National Association of Stormwater Management Agencies, the Association of state Floodplain Managers and the Missouri-Arkansas Association have led in promoting understanding of water challenges, needs and solution alternatives through active engagement with Federal agencies, states and local groups. They serve as a model to do more of the same.

Education and outreach are powerful communications strategies to remote collaborative and integrated water resources management.

Suggested Actions:

1. Develop and widely promulgate communications products (e.g., speeches, fact sheets, PowerPoint briefings,

¹⁷As another example, the Corps St. Louis District has a relationship with the National Great Rivers Research and Education Center (NGRREC), a partnership among the St. Louis District, the University of Illinois at Urbana-Champaign, the Illinois Natural History Survey, Lewis and Clark Community College, and the private and non-profit sectors to carry out research, modeling, monitoring, development of management strategies using a watershed approach, and education and outreach to a K-university student population and the scientific community for the purpose of studying the unique river ecology of the confluence of the Illinois River, the Missouri River and the Mississippi River.

brochures, handouts, an online newsletter, etc.) that convey common and key themes about water resources management, stewardship and sustainability

2. Develop an education campaign to educate state and Federal legislators (see **Iowa's** program).
3. Identify conferences, symposia, workshops and meetings, and working groups to leverage or follow on to in order to share information and create opportunities for collaboration, e.g., the USGS/DOI Advisory Committee on Water Information's (ACWI) Sustainable Water Resources Roundtable and the USGS Advisory Committee on Water Information (ACWI). Develop a catalogue of these events and share it through the *Federal Support Toolbox*.
4. Identify educational/outreach programs of each Federal agency and develop a multimedia communications strategy that seeks ways to connect and leverage them for greater impact.
5. Promulgate best practices and good examples of cooperative agreements and partnering agreements that promote outreach and education; identify way to build on them.



Conclusions



The results of the assessment conducted under the Corps *Collaborating for a Sustainable Water Future* initiative highlighted the states' needs for: more funding; better access to more complete, current and comprehensive data and information about water resources conditions, use, availability, planning and management; and more integrated water resources management to address and balance a myriad of water and related land resources and their uses. The Federal government can take the lead in helping the states meet these needs through collaboration and a refocusing of some Federal programs, respecting the states' primacy to lead their own water resources planning and management.

Resource constraints may be the greatest handicap to moving forward toward a sustainable water resources future, although shortages provide the impetus for pooling resources through partnerships. The recommendation most often cited throughout the assessment was the need for funding to address water resources challenges. The funding situation is complex and complicated by legal mandates, authorities, precedents and political realities. What is needed is to share information and to identify the funds and mechanisms to create common data portals to enable access to those who need the information for their planning.

Contemporary needs—not the least of which are ways to cope with portended deleterious climate change impacts—compel the search for ways to combine resources, reduce needless duplications and fill voids that must be addressed. Just as

information is crucial, information is critical for good planning and management. Information does not take care of itself; we must take care of it with reliable tools and a commitment to understand it and to expand it to promote deeper understanding about what it means and how it can be used better. The Federal government has a wealth of information and insight to share; the states also have invaluable lessons learned that merit sharing with counterparts across borders. The means must be found to enable this mutual sharing and cross-border learning. The states certainly have grown their water resources competency and can and have put together statewide water plans based on comprehensive and rigorous data collection and analysis. Nonetheless, the states often call for Federal assistance to advance their planning at local, regional and statewide levels.



The complexity of today's world merits the attention of the best and the brightest to develop and provide the tools and assistance that join people and ideas together. One mechanism is a holistic systems perspective that affords a means to link ideas to stakeholders to results through an appreciation of how they are all interconnected. Integrated water resources management (IWRM) is an ideal toward which to strive in order to manage multiple stakeholders intent on multiple water uses through multiple objectives for (more) balanced benefits. Robust concepts and models such as IWRM and adaptive management hold the promise to manage the true complexity and interdependencies that exist for water managed at a watershed scale. Integration can bring economy of effort and save resources to enable government at all levels to do more with fewer resources. Sustainable water resources management is more likely to emanate from processes and models that are robust enough to address growing water uses and users as the world becomes more complex. Integration will take clear policies, roles, responsibilities, definitions, examples and feedback. The Federal government seeks to improve its ability to provide such assistance to help states develop comprehensive and integrated plans at local, regional and statewide levels.

A Federal Support Toolbox of Federal authorities, technical tools, and scientific and management information would facilitate Federal agencies in supporting state water planning. Increasingly, planners recognize that water quality and quantity must be addressed together, that upstream and downstream planning must be instituted comprehensively and regionally, that surface and groundwater supplies must be planned for holistically as part of a unified water system, that conjunctive uses of water must strike a satisfactory balance for water



supplies and environmental protection, that diverse water purposes and objectives must be better balanced for use of common water bodies, and that multiple stakeholders and resources must be brought to the same planning table to encourage their perspectives, interests, ideas and resources to coalesce.

The Honorable Lisa Jackson, Administrator of the U.S. Environmental Protection Agency, told the National Conference attendees that “If we are going to lead the way, we must use all our foresight and creativity.”

There are opportunities to begin collaborating; expressed interest in a national water vision and unified policies requires continued conversation. We can wrestle with governance issues to clarify roles and responsibilities. We can probe and share information to improve understanding and mitigation of climate change impacts. We can better communicate implications of risk and build risk factors into decision models. And we can create vehicles by which to share information across levels of government better and more readily. We need to start now from where we are and leverage strategic alliances.

The Federal government, tribes, states, and interstate and nongovernment organizations have important roles to play, which can be made even more effective through collaboration or joined roles. Participants in this assessment offered the following role clarification:

Additional thought needs to be given to integration for water planning and management. The Federal government has a legitimate role to ensure consistency and equity across groups, especially to protect the disadvantaged. It has access to resources that can make a difference for research and development. It can collect, manage and provide access to aggregated databases about a wide spectrum of water and related land resources information and analyses. Many participants extolled the supporting role of the interstate entities as vanguards in furthering integrated approaches and outcomes. Moving forward is difficult because of the lack of an appropriate governance mechanism at the Federal level for integration across agencies and programs and the lack of funding, but we must begin.

In his speech at the National Conference, Chairman Oberstar noted that water is indispensable—the essence of life and a basic human right—but we take it for granted. Our Nation was founded on the water and by the water; yet, very little

freshwater available on the planet is available for human use. Unlike energy, water cannot be created; it can only be discovered. Chairman Oberstar called for a continuing conversation about water policy to address comprehensive Federal and state water planning at a watershed level. There is no justification for not acting, he said. "We must hand off a better planet to our grandchildren as custodians of our land and waters," he concluded.

The strategic direction of the Corps is consistent with the themes raised in this report and meeting 21st century needs collaboratively is a pressing priority. In the spirit of promoting transparency, collaboration and integrated water resources across the Nation, the Corps will continue to facilitate dialogue about the Nation's water challenges and ways to address them holistically and collaboratively to move efforts for sustainability forward through integrated water resources management. The findings and recommendations resulting from this assessment will be presented to decision makers within the Corps and the Administration. Documentation from this assessment will be posted on the Corps' website (www.building-collaboration-for-water.org). The momentum exists to move forward as a national team of strategic allies joined by shared aims for important work that has begun and must continue to protect and enhance our Nation's precious water resources.

This 2008/2009 *Collaborating for a Sustainable Water Future* assessment is just a beginning. It is not the conclusion about what should be done specifically by whom in particular ways. Much important work remains for many to do. Many topics, e.g., the energy-water-food nexus and coastal issues, need to be explored further. Hard work must be initiated on recommendations that go beyond this assessment. Water resources stakeholders at all levels must be involved in developing, refining and implementing recommendations for a stronger water future. A full Federal team could and should be engaged to continue the work. Collaboration will make the difference to ensure that this initiative counts. Respecting the primacy of states in identifying water resources needs and in allocating water resources, the Corps and other Federal agencies desire to provide leadership collaboratively on interstate and multistate issues as part of a national team to address these needs.

It is imperative for all of us to lead together for a more secure water future for the generations to come. Let's find ways to gather at the same table to continue this important work. The



first step toward success will be patience. The ultimate desired outcomes—a thriving economy, a healthy environment and a high quality of life in sustainable communities—cannot be achieved overnight. With collaboration, hard work in a deliberate and deliberative—not ad hoc—manner, patience and funding, our work can continue and pay off for the Nation’s benefit.



INTERVIEW PARTICIPANTS

STATE	ORGANIZATION/AGENCY NAME
STATES	
ALASKA	Alaska Department of Natural Resources, Water Resources Section
ARKANSAS	Arkansas Natural Resources Commission, Water Resources Management Division
ARIZONA	Arizona Department of Water Resources
CALIFORNIA	California Department of Water Resources
COLORADO	Colorado Water Conservation Board
DELAWARE	Delaware Department of Natural Resources and Environmental Control, Water Supply Section
FLORIDA	Florida Department of Environmental Protection, Office of Water Policy
GEORGIA	Georgia Department of Natural Resources, Environmental Protection Division
HAWAII	Commission on Water Resource Management
IOWA	Iowa Department of Natural Resources
IDAHO	Idaho Department of Water Resources, Water Planning Section
ILLINOIS	Illinois Department of Natural Resources, Office of Water Resources
INDIANA	Indiana Department of Water Resources, Division of Water
KANSAS	Kansas Water Office
KANSAS	Kansas Water Office Public Water Supply Planning
KANSAS	Kansas Water Office Watershed Unit
KENTUCKY	Kentucky Department of Environmental Protection, Division of Water
LOUISIANA	Louisiana Department of Natural Resources, Office of Conservation
MASSACHUSETTS	Executive Office of Energy and Environmental Affairs
MARYLAND	Maryland Department of the Environment, Office of the Secretary
MICHIGAN	Michigan Department of Environmental Quality, Office of the Great Lakes
MICHIGAN	Michigan Department of Environmental Quality, Water Division
MINNESOTA	Minnesota Environmental Quality Board
MISSOURI	Missouri Department of Natural Resources
MISSISSIPPI	Mississippi Department of Environmental Quality, Office and Land and Water Resources
MONTANA	Montana Department of Natural Resources and Conservation, Water Resources Division
MONTANA	Montana Department of Natural Resources and Conservation, Water Resources Division, Water Management Bureau
NEBRASKA	Nebraska Department of Natural Resources
NEBRASKA	Nebraska Department of Natural Resources, Planning and Assistance Division
NEW HAMPSHIRE	New Hampshire Department of Environmental Services, Drinking Water and Groundwater Bureau
NEW MEXICO	Office of the State Engineer
NEW MEXICO	Interstate Stream Commission

INTERVIEW PARTICIPANTS (continued)

STATE	ORGANIZATION/AGENCY NAME
STATES	
NEW YORK	New York Department of Environmental Conservation, Division of Water
NEW YORK	New York Department of Environmental Conservation, Division of Water, Water Quantity Management Section
NEVADA	Nevada Division of Water Resources
NORTH CAROLINA	North Carolina Department of Environment and Natural Resources, Division of Water Resources
NORTH DAKOTA	North Dakota State Water Commission
NORTH DAKOTA	North Dakota State Water Commission, Planning and Education Division
OHIO	Ohio Department of Natural Resources, Division of Water
OHIO	Ohio Department of Natural Resources, Division of Soil and Water Conservation
OKLAHOMA	Oklahoma Water Resources Board
OREGON	Oregon Water Resources Department
PENNSYLVANIA	Pennsylvania Department of Environmental Protection, Water Planning Office
RHODE ISLAND	Rhode Island Water Resources Board
SOUTH CAROLINA	South Carolina Department of Natural Resources, Land, Water and Conservation Division
SOUTH DAKOTA	South Dakota Department of Environment and Natural Resources, Water Rights Program
SOUTH DAKOTA	South Dakota Department of Environment and Natural Resources, Division of Financial and Technical Assistance
TENNESSEE	Tennessee Department of Environment and Conservation, Division of Water Supply
TEXAS	Texas Water Development Board, Water Resources and Planning
TEXAS	Texas Water Development Board, Water Science and Conservation
UTAH	Utah Division of Water Resources
VIRGINIA	Virginia Department of Environmental Quality, Office of Surface and Ground Water Supply Planning
VERMONT	Vermont Department of Environmental Conservation, Water Quality Division, Planning Section
WASHINGTON	Washington State Department of Ecology, Water Resources Program
WISCONSIN	Wisconsin Department of Natural Resources, Watershed Management Bureau
WISCONSIN	Wisconsin Department of Natural Resources, Office of the Great Lakes
WEST VIRGINIA	West Virginia Department of Environmental Protection, Division of Water and Waste Management
WYOMING	River Basin Planning
WYOMING	Wyoming Water Development Office



INTERVIEW PARTICIPANTS (continued)

ORGANIZATION/AGENCY NAME

NGOs

Delaware River Basin Commission
Great Lakes Commission
Interstate Commission on the Potomac River Basin
Susquehanna River Basin Commission
Upper Mississippi River Basin Commission

FEDERAL

Environmental Protection Agency, Office of Water
Federal Emergency Management Agency, Mitigation Directorate
National Oceanic and Atmospheric Administration, National Weather Service,
National Operational Hydrologic Remote Sensing Center
U.S. Army Corps of Engineers
U.S. Department of Agriculture, Natural Resources Conservation Service
U.S. Department of the Interior, Bureau of Land Management
U.S. Department of the Interior, Bureau of Reclamation
U.S. Fish and Wildlife Service
U.S. Forest Service
U.S. Geological Survey

CENTRAL REGIONAL CONFERENCE

STATE	ORGANIZATION/AGENCY NAME
MISSOURI	Agriservices Of Brunswick
	American Water Resources Association (AWRA)
ARKANSAS	Arkansas Natural Resources Commission
	Black & Veatch
	CDM
MISSOURI	East-West Gateway Council of Governments
	HDR
ILLINOIS	Illinois Department of Natural Resources
ILLINOIS	Illinois Office of Water Resources
COLORADO	Indian Water Working Group
INDIANA	Indiana Department of Natural Resources Division of Water
IOWA	Iowa Department of Natural Resources
KENTUCKY	Kentucky Department for Environmental Protection
LOUISIANA	Louisiana Office of Conservation
MISSOURI	Mid-America Regional Council
MINNESOTA	Minnesota Department of Natural Resources Division of Waters
MISSISSIPPI	Mississippi Department of Environmental Quality
MISSOURI	Missouri Department of Natural Resources
	Missouri-Arkansas River Basin Association
IOWA	National Mississippi River Museum & Aquarium
	National Oceanic and Atmospheric Administration
OKLAHOMA	Oklahoma Water Resources Board
PENNSYLVANIA	Susquehanna River Basin Commission
TENNESSEE	Tennessee Division Water Supply
	The Nature Conservancy
	USACE (U.S. Army Corps of Engineers)
	USACE Engineer Research and Development Center
	USACE Environmental Advisory Board
	USACE Great Lakes and Ohio River Division
	USACE Headquarters
	USACE Institute for Water Resources
	USACE Mississippi Valley Division
	USACE New Orleans District
	USACE Rock Island District
	U.S. Department of Agriculture, Natural Resources Conservation Service
	U.S. Department of the Interior, Bureau of Land Management
	U.S. Department of the Interior, Bureau of Reclamation
	U.S. Geological Survey
Upper Mississippi River Basin Association	
Upper Mississippi, Illinois and Missouri River Association	



EASTERN REGIONAL CONFERENCE

STATE	ORGANIZATION/AGENCY NAME
	American Water Resources Association
	Association of State Floodplain Managers
	CDM
NEVADA	Clark County Regional Flood Control District
DELAWARE	Delaware River Basin Commission
	Department of Environmental Protection
	Department of Environmental Quality
DC	District Department of the Environment
MASSACHUSETTS	Executive Office of Energy and Environmental Affairs
	Federal Emergency Management Agency, R4 Mitigation Division
GEORGIA	Georgia Environmental Protection Division
	Great Lakes Commission
	Interstate Commission on the Potomac River Basin
MARYLAND	Maryland Department of the Environment
	National Association of Flood & Stormwater Management Agencies
	National Oceanic and Atmospheric Administration
	National Science Foundation, WATERS Network
	Natural Resources Conservation Service
NEW HAMPSHIRE	New Hampshire Department of Environmental Services
	Office of the Secretary of the Army
OKLAHOMA	Oklahoma Water Resources Board
PENNSYLVANIA	Pennsylvania Department of Environmental Protection
RHODE ISLAND	Rhode Island Bays, Rivers, and Watersheds Coordination Team
SOUTH CAROLINA	South Carolina Department of Natural Resources
	Susquehanna River Basin Commission
	The Nature Conservancy
	USACE (U.S. Army Corps of Engineers)
	USACE Engineer Research and Development Center
	USACE Environmental Advisory Board
	USACE Great Lakes and Ohio River Division
	USACE North Atlantic Division
	USACE Rock Island District
	USACE South Atlantic Division
	U.S. Department of the Interior, Bureau of Reclamation
	U.S. Geological Survey
FLORIDA	University of Florida
GEORGIA	University of Georgia, Vinson Institute of Government
WEST VIRGINIA	West Virginia Department of Environmental Protection

WESTERN REGIONAL CONFERENCE

STATE	ORGANIZATION/AGENCY NAME
	American Water Resources Association
CALIFORNIA	California Marine Affairs and Navigation Conference
	CDM
COLORADO	Colorado Water Conservation Board
	Crowell and Moring
	Delaware River Basin Commission
	Division of Water Resources
	Environmental Protection Agency, Region 7
HAWAII	Hawaii State Department of Land & Natural Resources, Commission on Water Resource Management
IDAHO	Idaho Department of Water Resources
KANSAS	Kansas Department of Agriculture
KANSAS	Kansas Department of Health and Environment
KANSAS	Kansas Water Office
	KRT Consultants, LLC
	Missouri Basin River Forecast Center
MISSOURI	Missouri Department of Natural Resources
	Missouri River Association of States and Tribes
	Missouri-Arkansas River Basin Association
	Mullican and Associates
	National Association of Flood & Stormwater Management Agencies
	National Oceanic and Atmospheric Administration
	NOAA National Weather Service
	National Waterways Conference, Inc.
NEBRASKA	Nebraska Department of Natural Resources
NEW MEXICO	New Mexico Office of the State Engineer
NORTH DAKOTA	North Dakota State Water Commission
OKLAHOMA	Oklahoma Water Resources Board
OREGON	Oregon Water Resources Department
CALIFORNIA	Santa Margarita Water District/University of California Irvine
	Seneca-Cayuga Tribe
SOUTH DAKOTA	South Dakota Department of Environment and Natural Resources, Water Rights
TEXAS	Tarrant Regional Water District
TEXAS	Texas A&M University
TEXAS	Texas Water Development Board
	The Nature Conservancy
	USACE (U.S. Army Corps of Engineers)
	USACE Engineer Research and Development Center
	USACE Environmental Advisory Board



WESTERN REGIONAL CONFERENCE (continued)

STATE	ORGANIZATION/AGENCY NAME
	USACE Institute for Water Resources
	USACE Kansas City District
	USACE Northwestern Division
	USACE Pacific Ocean Division
	USACE Pacific Ocean Division PDC
	USACE Southwestern Division
	USACE Tulsa District
	U.S. Department of Agriculture, Natural Resources Conservation Service
	U.S. Department of the Interior, Bureau of Land Management
	U.S. Department of the Interior, Bureau of Reclamation
	U.S. Geological Survey
	U.S. Institute for Environmental Conflict Resolution
CALIFORNIA	University of California Irvine
FLORIDA	University of Florida
UTAH	Utah Division of Water Resources
	Western States Water Council
WYOMING	Wyoming State Engineer's Office
WYOMING	Wyoming Water Development Office

NATIONAL CONFERENCE

STATE	ORGANIZATION/AGENCY NAME
STATES	
ALABAMA	Alabama Office of Water Resources
ARKANSAS	Arkansas Natural Resources Commission
CALIFORNIA	California Department of Water Resources
NEVADA	Clark County Regional Flood Control District
COLORADO	Colorado Water Conservation Board
	Department of Environmental Quality
DC	District Department of the Environment
	Environmental Stewardship & Water Management
	Executive Office of Energy and Environmental Affairs
GEORGIA	Georgia Department of Natural Resources
ILLINOIS	Illinois State Water Survey
KANSAS	Kansas Department of Agriculture, Division of Water Resources
KANSAS	Kansas Water Office
MARYLAND	Maryland Department of the Environment
MINNESOTA	Minnesota Environmental Quality Board
MISSOURI	Missouri Department of Natural Resources
MONTANA	Montana Department of Natural Resources and Conservation, Water Operations Bureau
NEW HAMPSHIRE	New Hampshire Department of Environmental Services
NEW MEXICO	New Mexico Office of the State Engineer
NORTH CAROLINA	North Carolina Department of Environment and Natural Resources, Division of Water Resources
NORTH DAKOTA	North Dakota State Water Commission
OHIO	Ohio Department of Natural Resources
OKLAHOMA	Oklahoma Water Resources Board
OREGON	Oregon Water Resources Congress
RHODE ISLAND	Rhode Island Bays, Rivers, and Watersheds Coordination Team
	Santa Clara Valley Water District
SOUTH CAROLINA	South Carolina Department of Natural Resources
FLORIDA	South Florida Water Management District
TEXAS	Texas Water Development Board
FLORIDA	University of Florida
MARYLAND	University of Maryland
NEW ORLEANS	University of New Orleans
WEST VIRGINIA	West Virginia Department of Environmental Protection



NATIONAL CONFERENCE (continued)**STATE****ORGANIZATION/AGENCY NAME****NGOs**

American Society of Civil Engineers
 American Water Resources Association
 AWRA, Texas A&M AgriLife Research Center at El Paso
 Association of State Drinking Water Administrators
 Association of State Floodplain Managers
 California Marine Affairs and Navigation Conference
 Council of Great Lakes Governors
 Interstate Council on Water Policy
 Missouri-Arkansas River Basin Association
 National Association of Flood and Stormwater Management Agencies
 National Mississippi River Museum and Aquarium
 National Science Foundation
 National Waterways Conference
 The Nature Conservancy
 Western Governors' Association

INTERSTATE AGENCIES

Delaware River Basin Commission
 Interstate Commission on the Potomac River Basin
 Missouri River Association of States and Tribes
 New England Interstate Water Pollution Control Commission
 Susquehanna River Basin Commission
 Upper Mississippi River Basin Association
 Upper Mississippi, Illinois and Missouri River Association
 Western States Water Council

OTHER

BlueSkyz
 CDM
 House of Representatives
 House Transportation and Infrastructure Committee
 Kelly & Weaver P.C.
 Marlowe & Company
 MWH Americas
 Shaw Environmental & Infrastructure
 Subcommittee on Water Resources and Environment
 Watercat Consulting LLC

NATIONAL CONFERENCE (continued)

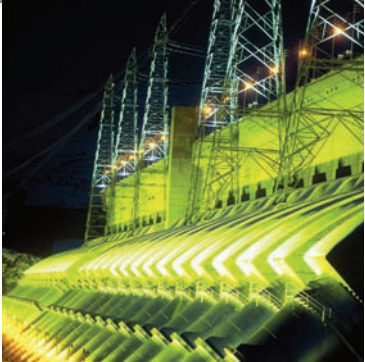
STATE

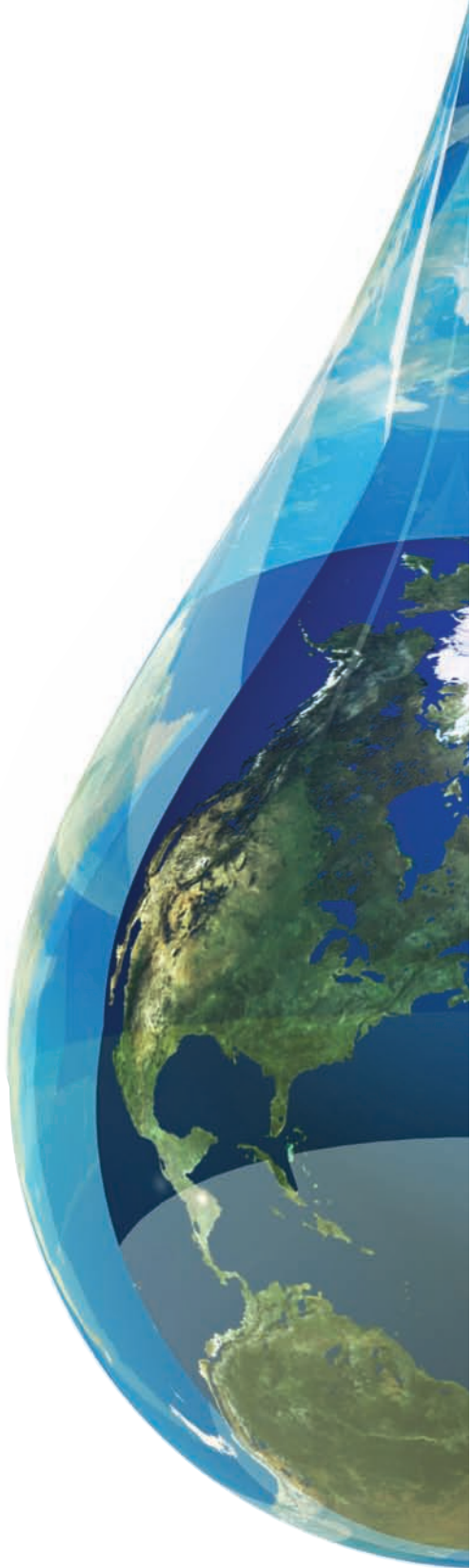
ORGANIZATION/AGENCY NAME

FEDERAL AGENCIES

Assistant Secretary of Army (Civil Works)
Council of Environmental Quality
U.S. Department of the Interior
U.S. Department of the Interior, Bureau of Land Management
U.S. Department of the Interior, Bureau of Reclamation
Federal Emergency Management Agency
Federal Emergency Management Agency, Mitigation Directorate
National Oceanic and Atmospheric Administration
NOAA National Weather Service
NOAA NWS National Operational Hydrologic Remote Sensing Center
NOAA Oceanic and Atmospheric Research
Office of Federal Coordinator for Meteorology
USACE (U.S. Army Corps of Engineers)
USACE Cold Regions Research and Engineering Laboratory
USACE Engineer Research and Development Center
USACE Environmental Advisory Board
USACE Great Lakes and Ohio River Division
USACE Headquarters
USACE Institute for Water Resources
USACE Mississippi Valley Division
USACE North Atlantic Division
USACE Northwestern Division
USACE Pacific Ocean Division
USACE South Atlantic Division
USACE South Pacific Division
USACE Southwestern Division
U.S. Department of Agriculture
U.S. Department of Agriculture, Forest Service
U.S. Department of Agriculture, Natural Resources Conservation Service
U.S. Department of Agriculture, NRCS National Water Management
U.S. Department of Agriculture, Renewable Energy, Natural Resources, and Environment
U.S. Environmental Protection Agency
U.S. Environmental Protection Agency, Office of Water
U.S. Fish and Wildlife Service
U.S. Geological Survey
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