



## I. Executive Summary

**C**LIMATE CHANGE poses significant challenges to water resources and the Environmental Protection Agency's (EPA) National Water Program (NWP). The *NWP 2012 Strategy: Response to Climate Change* addresses climate change in the context of our water programs. It emphasizes assessing and managing risk and incorporating adaptation into core programs. Many of the programs and activities already underway throughout the NWP—such as protecting healthy watersheds and wetlands; managing stormwater with green infrastructure; and improving the efficiency and sustainability of water infrastructure, including promoting energy and water efficiency, reducing pollutants, and protecting drinking water and public health—are even more important to do in light of climate change. However, climate change poses such significant challenges to the nation's water resources that more transformative approaches will be necessary. These include critical reflection on programmatic assumptions and development and implementation of plans to address climate change's challenges.

This *2012 Strategy* articulates such an approach. The reader is advised not to interpret the framing of individual strategic actions that use terms such as "encourage" or "consider" to mean that the NWP doesn't recognize the urgency of action. Rather, we recognize that adaptation is itself transformative and requires a collaborative, problem-solving approach, especially in a resource-constrained environment. Further, "adaptive management" doesn't imply a go-slow or a wait-and-see approach; rather, it is an active approach to understand vulnerability, reduce risk, and prepare for consequences while incorporating new science and lessons learned along the way.

**EPA Vision:** Despite the ongoing effects of climate change, the National Water Program will continue to achieve its mission to protect and restore our waters to ensure that drinking water is safe; and that aquatic ecosystems sustain fish, plants, and wildlife, as well as economic, recreational, and subsistence activities.

EPA National Water Program 2012 Strategy:  
Response to Climate Change

## Impacts of Climate Change on Water Resources

- **Increases in water pollution problems due to warmer air and water temperatures and changes in precipitation patterns**, causing an increase in the number of waters categorized as “impaired,” with associated impacts on human health and aquatic ecosystems.
- **Impacts on water infrastructure and aquatic systems due to more extreme weather events**, including heavier precipitation and tropical and inland storms.
- **Changes in the availability of drinking water supplies** due to increased frequency, severity and duration of drought, changing patterns of precipitation and snowmelt, increased evaporation, and aquifer saltwater intrusion, affecting public water supply, agriculture, industry, and energy production uses.
- **Water body boundary movement and displacements** as rising sea levels alter ocean and estuarine shorelines and as changes in water flow, precipitation, and evaporation affect the size of wetlands and lakes.
- **Changing aquatic biology** due to warmer water and changing flows, resulting in deterioration of aquatic ecosystem health in some areas.
- **Collective impacts on coastal areas** resulting from a combination of sea level rise, increased damage from floods and storms, coastal erosion, saltwater intrusion to drinking water supplies, and increasing temperature and acidification of the oceans.
- **Indirect impacts** due to unintended consequences of human response to climate change, such as those resulting from, for example, armoring shorelines or carbon sequestration and other greenhouse gas reduction strategies.

## A. The Evolving Context

The first *National Water Program Strategy: Response to Climate Change* was published in 2008; it identified 44 key actions that could be taken in the near term to begin to understand and address the potential impacts of climate change on water resources and EPA’s mission. This *2012 Strategy* builds on the momentum gained since then; it describes a set of long-term goals for the management of sustainable water resources for future generations in light of climate change, and charts the key “building blocks,” (i.e., strategic actions) that would need to be taken to achieve those goals. It also reflects the wider context of climate change-related activity that is underway throughout the nation. The *2012 Strategy* is intended to be a roadmap to guide future programmatic planning and inform decision-makers during the Agency’s annual planning process. It describes an array of important actions that should be taken to be a “climate ready” national water program.

A cross-Agency workgroup embraced 10 guiding principles to inform development of the revised and updated *NWP 2012 Strategy*. In addition, the *2012 Strategy* is designed to reflect the findings of the Interagency Climate Change Adaptation Task Force (ICCATF) and includes EPA’s commitments under three climate change strategic plans under development within the federal government for:

- Freshwater resources by the ICCATF Freshwater Work Group.
- The ocean, coasts, and Great Lakes by the National Ocean Council (NOC).
- Fish, wildlife, and plants by the National Fish, Wildlife and Plants Climate Adaptation Workgroup.

This *2012 Strategy* is also intended to be consistent with EPA’s broader adaptation planning. Recognizing that climate change is one stressor among many others that water resource managers are grappling with, this strategy is also designed to build on other initiatives, such as the recent *Coming Together for Clean Water* strategy and EPA’s *Clean Water and Safe Drinking Water Infrastructure Sustainability Policy*.

## B. Programmatic Visions, Goals, and Strategic Actions

The core programmatic elements of this strategy include:

- Infrastructure
- Watersheds and Wetlands
- Coastal and Ocean Waters
- Protecting Water Quality
- Working with Tribes

Each section addressing these core elements is organized using a three-tier framework: *Vision, Goals, and Strategic Actions*.

Each section includes a long-term **Vision**, or outcome, for which EPA may be only one of many actors.

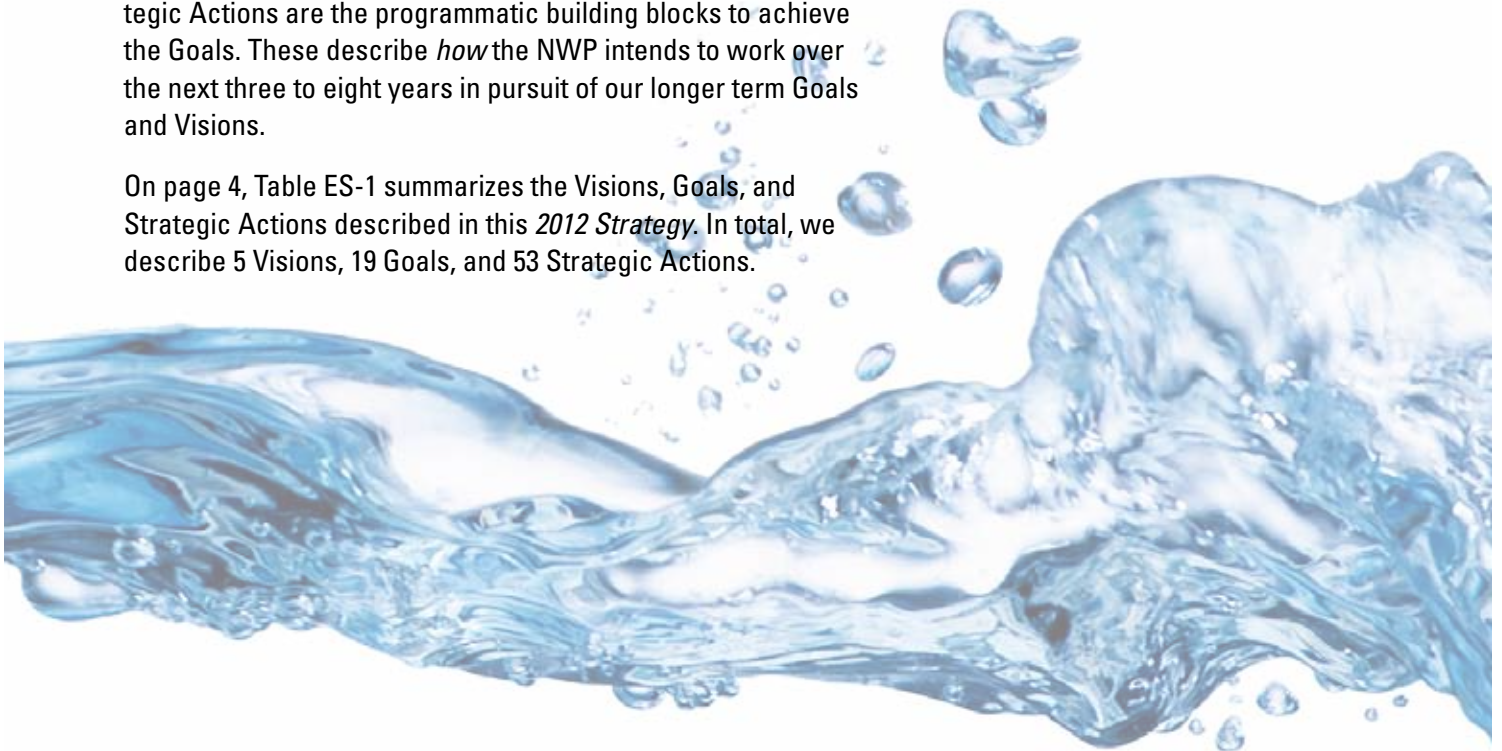
For each Vision, we identify a set of **Goals** that reflects the same long-term timeframe as the Vision. The Goals, however, articulate EPA's mission and role in achieving the Vision, and describe *what* we are trying to achieve.

Finally, each Goal contains several **Strategic Actions**. The Strategic Actions are the programmatic building blocks to achieve the Goals. These describe *how* the NWP intends to work over the next three to eight years in pursuit of our longer term Goals and Visions.

On page 4, Table ES-1 summarizes the Visions, Goals, and Strategic Actions described in this *2012 Strategy*. In total, we describe 5 Visions, 19 Goals, and 53 Strategic Actions.

### Ten Guiding Principles

- **Integrated Water Resources Management (IWRM)**
- **Adaptive Management**
- **Collaborative Learning and Capacity Development**
- **Long Term Planning (i.e., multi-decadal time horizon)**
- **Energy-Water Nexus**
- **Systems & Portfolio Approach**
- **Cost of Inaction**
- **Environmental Justice**
- **Performance Evaluation**
- **Mainstreaming Climate Change into Core Programs**



**Table ES-1: Summary of Visions, Goals, and Strategic Actions**

<p><b>Infrastructure:</b> In the face of a changing climate, resilient and adaptable drinking water, wastewater, and stormwater utilities (i.e., the water utility sector) ensure clean and safe water to protect the nation’s public health and environment by making smart investment decisions to improve the sustainability of their infrastructure and operations and the communities they serve, while reducing greenhouse gas emissions through greater energy efficiency.</p>	
<p><b>Goal 1:</b> Build the body of information and tools needed to incorporate climate change into planning and decision making.</p>	<p><b>SA1:</b> Improve access to vetted climate and hydrological science, modeling, and assessment tools through the Climate Ready Water Utilities program.</p>
	<p><b>SA2:</b> Assist wastewater and water utilities to reduce greenhouse gas emissions and increase long-term sustainability with a combination of energy efficiency, co-generation, and increased use of renewable energy resources.</p>
	<p><b>SA3:</b> Work with the states and public water systems, particularly small water systems, to identify and plan for climate change challenges to drinking water safety and to assist in meeting health based drinking water standards.</p>
	<p><b>SA4:</b> Promote sustainable design approaches to provide for the long-term sustainability of infrastructure and operations.</p>
<p><b>Goal 2:</b> Support Integrated Water Resources Management to sustainably manage water resources.</p>	<p><b>SA5:</b> Understand and promote through technical assistance the use of water supply management strategies.</p>
	<p><b>SA6:</b> Evaluate and provide technical assistance on the use of water demand management strategies.</p>
	<p><b>SA7:</b> Increase cross-sector knowledge of water supply climate challenges and develop watershed specific information to inform decision making.</p>



## Response to Climate Change

**Table ES-1: Summary of Visions, Goals, and Strategic Actions (cont.)**

<b>Watersheds &amp; Wetlands:</b> Watersheds are protected, maintained, and restored to provide climate resilience and to preserve the ecological, social, and economic benefits they provide; and the nation’s wetlands are maintained and improved using integrated approaches that recognize their inherent value as well as their role in reducing the impacts of climate change.	
<b>Goal 3:</b>  Identify, protect, and maintain a network of healthy watersheds and supportive habitat corridor networks.	<b>SA8:</b> Develop a national framework and support efforts to protect remaining healthy watersheds and aquatic ecosystems.
	<b>SA9:</b> Collaborate with partners on terrestrial ecosystems and hydrology so that effects on water quality and aquatic ecosystems are considered.
	<b>SA10:</b> Integrate protection of healthy watersheds throughout the NWP core programs.
	<b>SA11:</b> Increase public awareness of the role and importance of healthy watersheds in reducing the impacts of climate change.
<b>Goal 4:</b>  Incorporate climate resilience into watershed restoration and floodplain management.	<b>SA12:</b> Consider a means of accounting for climate change in EPA funded and other watershed restoration projects.
	<b>SA13:</b> Work with federal, state, interstate, tribal, and local partners to protect and restore the natural resources and functions of riverine and coastal floodplains as a means of building resiliency and protecting water quality.
<b>Goal 5:</b>  Watershed protection practices incorporate Source Water Protection to protect drinking water supplies.	<b>SA14:</b> Encourage states to update their source water delineations, assessments or protection plans to address anticipated climate change impacts.
	<b>SA15:</b> Continue to support collaborative efforts to increase state and local awareness of source water protection needs and opportunities, and encourage inclusion of source water protection areas in local climate change adaptation initiatives.
<b>Goal 6:</b>  EPA incorporates climate change considerations into its wetlands programs, including the Clean Water Act 404 program, as appropriate.	<b>SA16:</b> Consider the effects of climate change, as appropriate, when making significant degradation determinations in the CWA Section 404 wetlands permitting and enforcement program.
	<b>SA17:</b> Evaluate, in conjunction with the U.S. Army Corps of Engineers, how wetland and stream compensation projects could be selected, designed, and sited to aid in reducing the effects of climate change.

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**Table ES-1: Summary of Visions, Goals, and Strategic Actions (cont.)**

<p><b>Goal 7:</b></p> <p>Improve baseline information on wetland extent, condition, and performance to inform long term planning and priority setting that takes into account the potential added benefits for climate change adaptation and carbon sequestration.</p>	<p><b>SA18:</b> Expand wetland mapping by supporting wetland mapping coalitions and training on use of the new federal Wetland Mapping Standard.</p>
	<p><b>SA19:</b> Produce a statistically valid ecological condition assessment of the nation’s wetlands.</p>
	<p><b>SA20:</b> Work with partners and stakeholders to develop information and tools to support long term planning and priority setting for wetland restoration projects.</p>
<p><b>Coastal and Ocean Waters:</b> Adverse effects of climate change along with collective stressors and unintended adverse consequences of responses to climate change have been successfully prevented or reduced in the ocean and coastal environment. Federal, tribal, state and local agencies, organizations, and institutions are working cooperatively; and information necessary to integrate climate change considerations into ocean and coastal management is produced, readily available, and used.</p>	
<p><b>Goal 8:</b></p> <p>Collaborate so that information and methodologies for ocean and coastal areas are collected, produced, analyzed, and easily available.</p>	<p><b>SA21:</b> Collaborate so that synergy occurs, lessons learned are transferred, federal efforts effectively help local communities, and efforts are not duplicative or at cross-purposes.</p>
	<p><b>SA22:</b> Work within EPA and with the U.S. Global Change Research Program and other federal, tribal, and state agencies to collect, produce, analyze, and format knowledge and information needed to protect ocean and coastal areas and make it easily available.</p>
<p><b>Goal 9:</b></p> <p>Support and build networks of local, tribal, state, regional and federal collaborators to take effective adaptation measures for coastal and ocean environments through EPA’s geographically targeted programs.</p>	<p><b>SA23:</b> Work with the NWP’s larger geographic programs to incorporate climate change considerations, focusing on both the natural and built environments.</p>
	<p><b>SA24:</b> Address climate change adaptation and build stakeholder capacity when implementing National Estuary Program Comprehensive Conservation and Management Plans and through the Climate Ready Estuaries Program.</p>
	<p><b>SA25:</b> Conduct outreach and education, and provide technical assistance to state and local watershed organizations and communities to build adaptive capacity in coastal areas outside the NEP and Large Aquatic Ecosystem programs.</p>



## Response to Climate Change

**Table ES-1: Summary of Visions, Goals, and Strategic Actions (cont.)**

<p><b>Goal 10:</b></p> <p>Address climate driven environmental changes in coastal areas and provide that mitigation and adaptation are conducted in an environmentally responsible manner.</p>	<p><b>SA26:</b> Support coastal wastewater, stormwater, and drinking water infrastructure owners and operators in reducing climate risks and encourage adaptation in coastal areas.</p>
	<p><b>SA27:</b> Support climate readiness of coastal communities, including hazard mitigation, pre-disaster planning, preparedness, and recovery efforts.</p>
	<p><b>SA28:</b> Support preparation and response planning for impacts to coastal aquatic environments.</p>
<p><b>Goal 11:</b></p> <p>Protect ocean environments by incorporating shifting environmental conditions and other emerging threats into EPA programs.</p>	<p><b>SA29:</b> Consider climate change impacts on marine water quality in NWP ocean management authorities, policies, and programs.</p>
	<p><b>SA30:</b> Use available authorities and work with the regional ocean organizations and other federal and state agencies through regional ocean groups and other networks so that offshore renewable energy production does not adversely affect the marine environment.</p>
	<p><b>SA31:</b> Support the evaluation of sub-seabed sequestration of carbon dioxide and any proposals for ocean fertilization.</p>
	<p><b>SA32:</b> Participate in interagency development and implementation of federal strategies through the National Ocean Council and the National Ocean Council Strategic Action Plans.</p>
<p><b>Water Quality:</b> Our Nation’s surface water, drinking water, and ground water quality are protected, and the risks of climate change to human health and the environment are diminished, through a variety of adaptation and mitigation strategies.</p>	
<p><b>Goal 12:</b></p> <p>Protect waters of the United States and promote management of sustainable surface water resources.</p>	<p><b>SA33:</b> Encourage states and communities to incorporate climate change considerations into their water quality planning.</p>
	<p><b>SA34:</b> Encourage green infrastructure and low-impact development to protect water quality and make watersheds more resilient.</p>
	<p><b>SA35:</b> Promote consideration of climate change impacts by National Pollutant Discharge Elimination System (NPDES) permitting authorities.</p>
	<p><b>SA36:</b> Encourage water quality authorities to consider climate change impacts when developing wasteload and load allocations in Total Maximum Daily Loads where appropriate.</p>
	<p><b>SA37:</b> Identify and protect designated uses that are at risk from climate change impacts.</p>
	<p><b>SA38:</b> Clarify how to re-evaluate aquatic life water quality criteria on more regular intervals; and develop information to assist states and tribes who are developing criteria that incorporate climate change considerations for hydrologic condition.</p>

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**Table ES-1: Summary of Visions, Goals, and Strategic Actions (cont.)**

<p><b>Goal 13:</b></p> <p>As the nation makes decisions to reduce greenhouse gases and develop alternative sources of energy and fuel, work to protect water resources from unintended adverse consequences.</p>	<p><b>SA39:</b> Continue to provide perspective on the water resource implications of new energy technologies.</p>
	<p><b>SA40:</b> Provide assistance to states and permittees to assure that geologic sequestration of CO<sub>2</sub> is responsibly managed.</p>
	<p><b>SA41:</b> Continue to work with States to help them identify polluted waters, including those affected by biofuels production, and help them develop and implement Total Maximum Daily Loads (TMDLs) for those waters.</p>
	<p><b>SA42:</b> Provide informational materials for stakeholders to encourage the consideration of alternative sources of energy and fuels that are water efficient and maintain water quality.</p>
	<p><b>SA43:</b> As climate change affects the operation or placement of reservoirs, work with other federal agencies and EPA programs to understand the combined effects of climate change and hydropower on flows, water temperature, and water quality.</p>
<p><b>Goal 14:</b></p> <p>Collaborate to make hydrological and climate data and projections available.</p>	<p><b>SA44:</b> Monitor climate change impacts to surface waters and ground water.</p>
	<p><b>SA45:</b> Collaborate with other federal agencies to develop new methods for use of updated precipitation, storm frequency, and observational streamflow data, as well as methods for evaluating projected changes in low flow conditions.</p>
	<p><b>SA46:</b> Enhance flow estimation using National Hydrography Dataset Plus (NHDPlus).</p>
<p><b>Working With Tribes:</b> Tribes are able to preserve, adapt, and maintain the viability of their culture, traditions, natural resources, and economies in the face of a changing climate.</p>	
<p><b>Goal 15:</b></p> <p>Incorporate climate change considerations in the implementation of core programs, and collaborate with other EPA offices and federal agencies to work with tribes on climate change issues on a multi-media basis.</p>	<p><b>SA47:</b> Through formal consultation and other mechanisms, incorporate climate change as a key consideration in the revised NWP Tribal Strategy and subsequent implementation of Clean Water Act, Safe Drinking Water Act, and other core programs.</p>
	<p><b>SA48:</b> Incorporate adaptation into tribal funding mechanisms, and collaborate with other EPA and federal funding programs to support sustainability and adaptation in tribal communities.</p>
<p><b>Goal 16:</b></p> <p>Tribes have access to information on climate change for decision making.</p>	<p><b>SA49:</b> Collaborate to explore and develop climate change science, information, and tools for tribes, and incorporate local knowledge.</p>
	<p><b>SA50:</b> Collaborate to develop communication materials relevant for tribal uses and tribal audiences.</p>



## Response to Climate Change

**Table ES-1: Summary of Visions, Goals, and Strategic Actions (cont.)**

Cross-Cutting Program Support	
<p><b>Goal 17:</b></p> <p>Communicate, Collaborate, and Train.</p>	<p><b>SA51:</b> Continue building the communication, collaboration, and training mechanisms needed to effectively increase adaptive capacity at the federal, tribal, state, and local levels.</p>
<p><b>Goal 18:</b></p> <p>Track Progress and Measure Outcomes</p>	<p><b>SA52:</b> Adopt a phased approach to track programmatic progress towards Strategic Actions; achieve commitments reflected in the Agency's <i>Strategic Plan</i>; work with an EPA workgroup to develop outcome measures.</p>
<p><b>Goal 19:</b></p> <p>Identify Climate Change and Water Research Needs</p>	<p><b>SA53:</b> Work with EPA's Office of Research and Development, other water science agencies, and the water research community to further define needs and develop research opportunities to deliver the information needed to support implementation of this <i>2012 Strategy</i>, including providing the decision support tools needed by water resource managers.</p>



## C. Geographic Climate Regions

This section describes the collective strategic focus of EPA Regions working together, organized by the climate impact regions delineated by the U.S. Global Change Research Program (USGCRP), with the addition of a “Montane” region (Table ES-2). Several EPA Regions span multiple USGCRP regions and therefore, each EPA Region will address a variety of climate impacts in its program implementation.

Successfully achieving the long-term goals will result from strong partnerships with federal agencies, states, interstates, tribes, local governments, nongovernmental, and private sector stakeholders. Specific partnerships in each climate region will vary according to the needs and issues of that region. Of particular importance are the federal efforts underway by the ICCATF to develop “regional consortia” of federal agencies to coordinate delivery of climate services to regional and local stakeholders that include, among others, Landscape Conservation Cooperatives (LCCs) and Climate Science Centers (CSCs) launched by the Department of the Interior, and the National Oceanic and Atmospheric Administration’s (NOAA’s) Regional Integrated Sciences and Assessments (RISAs) and National Climatic Data Centers.

## D. Cross-Cutting Program Support

This section describes essential processes to support and effectively implement the Visions, Goals, and Strategic Actions.

**Communication, Collaboration, and Training:** The NWP intends to strengthen and expand collaboration, outreach, and training with key partners throughout EPA and with other federal agencies; state, interstate, tribal, and local water program managers; and nongovernmental and private sector stakeholders, using both formal and informal stakeholder involvement opportunities.

**Tracking Progress and Measuring Outcomes:** Measuring progress toward adaptation is complicated. The current state of practice leans largely to tracking institutional *progress* in incorporating climate change considerations into programs. Similarly, the NWP is developing an approach that evaluates the collectivity of outputs and actions to demonstrate progress in each of several phases toward achieving resilience to climate change, noted in Table ES-3. The NWP intends to work with the State-Tribal Climate Change Council and other partners to refine this approach. As EPA and the ICCATF develop methods



**Table ES-2**

**USGCRP Climate Regions and EPA Regions**

Climate Regions	EPA Regions
Northeast	1, 2, 3
Southeast	3, 4, 6
Midwest	2, 5, 7
Great Plains	6, 7, 8
Southwest	6, 8, 9
Pacific Northwest	8, 10
Montane	8, 9, 10
Alaska	10
Caribbean Islands	2

## Response to Climate Change

for measuring *outcomes*, the NWP intends to incorporate those measures into its evaluation process. In addition, this *2012 Strategy* reflects the NWP's intent to meet the Agency-wide strategic measures adopted in the *EPA 2011–2015 Strategic Plan* and achieve measures embodied in future EPA Strategic Plans.

**Climate Change and Water Research Needs:** The *2012 Strategy* identifies the types of research needed to support the goals and strategic actions. The NWP intends to continue to work with the EPA's Office of Research and Development (ORD), other water science agencies, and the water research community to further define needs and develop collaborative and coordinated research opportunities.

### Conclusion

Climate change alters the hydrological background in which EPA's programs function. In response, EPA intends to evaluate the need to revise data collection, analytical methods, and even regulatory practices that have been developed over the past 40 years since passage of the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA). This is no easy task; ensuring that EPA's programs continue to protect public health and the environment and sustain the economy calls for immediate and sustained collaboration at the federal, state, interstate, tribal, and local levels.

**Table ES-3**

### Tracking Progress: Phases of Organizational Adaptation

1. Initiation	1
2. Assessment	2
3. Response Development	3
4. Initial Implementation	4
5. Robust Implementation	5
6. Mainstreaming	6
7. Monitoring and Adaptive Management	7



