

This presentation premiered at WaterSmart Innovations

watersmartinnovations.com



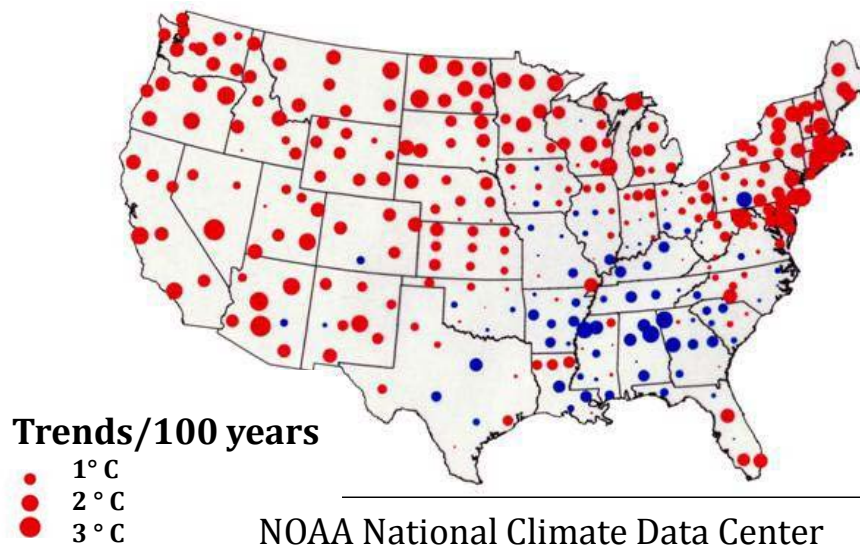


Water Smart Innovations

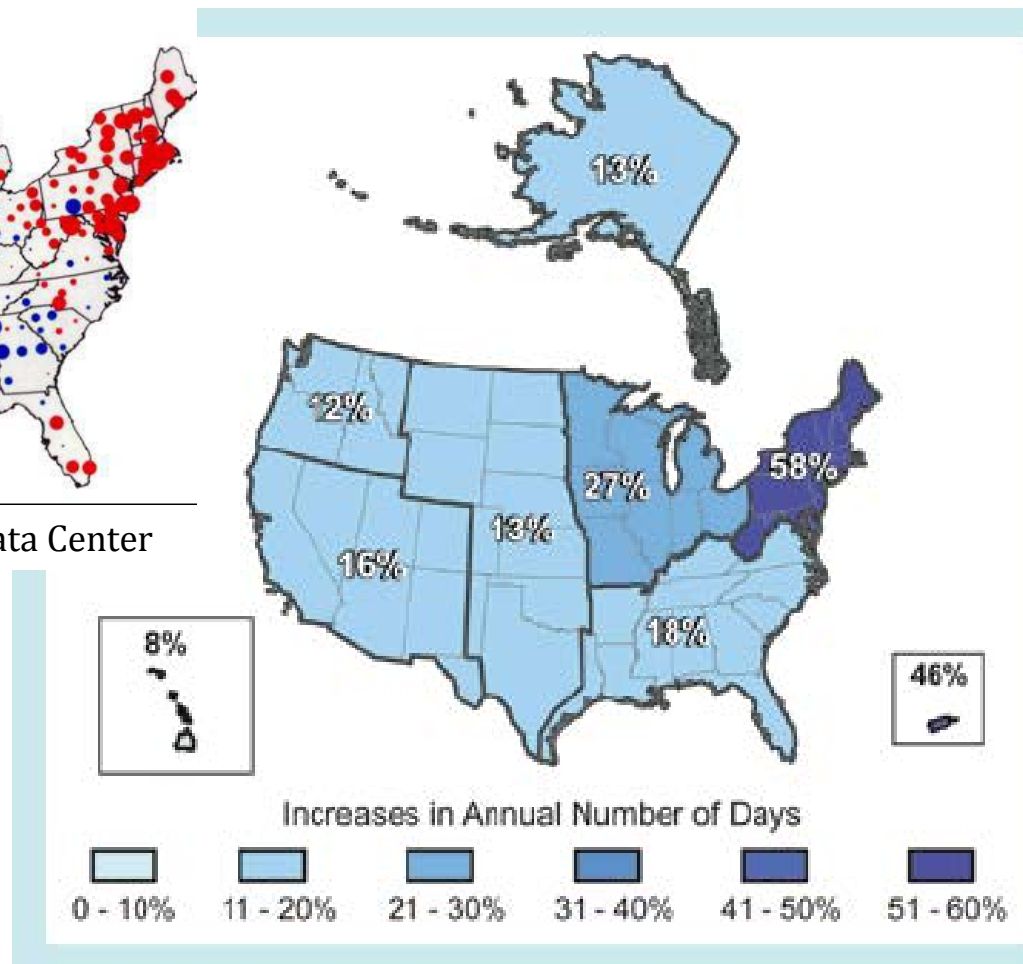
October 6, 2011

- Climate change impacts on utilities
- Overview of CRWU initiative
- Ongoing CRWU efforts
 - Adaptation Strategies Guide
 - Climate Resilience Evaluation and Awareness Tool
 - CRWU Toolbox
- Questions?

Climate Change Trends



- Increasing temperatures
- Increasing heavy precipitation
- Projections:
 - seasonal drought
 - sea level rise



Groisman et al. 2005

Water Quantity/Quality

Issues

- Hydrologic cycle: earlier snow melt, drier summers
- Sea level rise
- Heavy precipitation events: runoff of sediments, nutrients, DOC, pathogens, pesticides, and salt
- Warmer temperatures: lower DO, watershed fires, and algal blooms

Extreme Weather Events

- Hurricanes
- Floods



Operational Rules and Regulatory Issues

- Challenges meeting Environmental and Public Health Missions
- Complex puzzle that challenges water sector sustainability



Mission

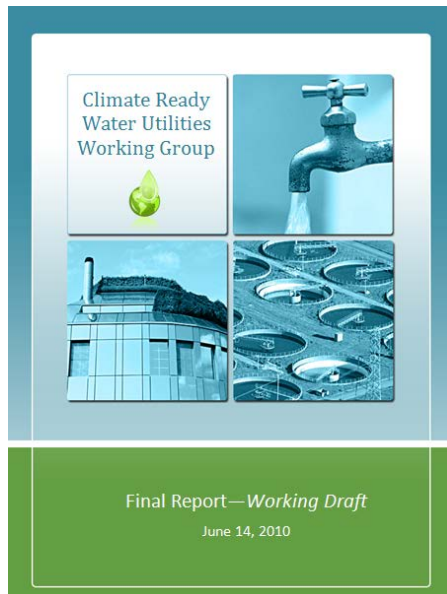
Lead to provide the water sector (drinking water, wastewater, and storm water) with the practical tools, training, and technical assistance needed to adapt to climate change by promoting a clear understanding of climate science and adaptation options.

NDWAC CRWU Report

Final WG report provides EPA with recommendations on developing a CRWU initiative to support water sector climate resiliency.

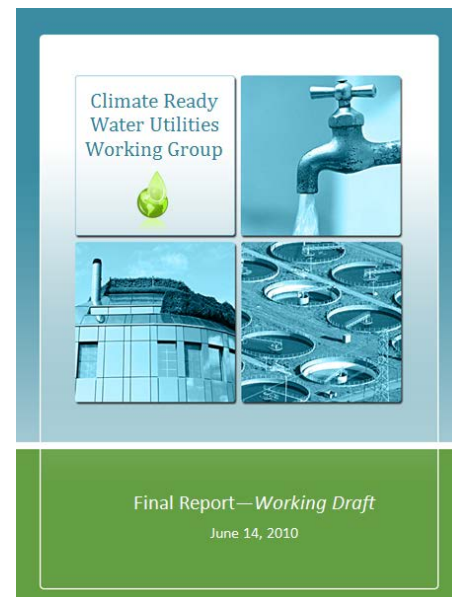
Developing an Adaptive Response Framework

Fundamental guide to build out the concept of a climate ready water utility, integrates with other tools.



What does CRWU Report Mean for EPA?

- EPA create and implement a CRWU program
- Integrate CRWU into existing EPA efforts
- Coordinate with other federal partners, states, associations, utilities
- Promote watershed planning and encourage adoption of integrated water resources management
- Recommends developing adaptive regulatory capacity





Adaptive Response Framework

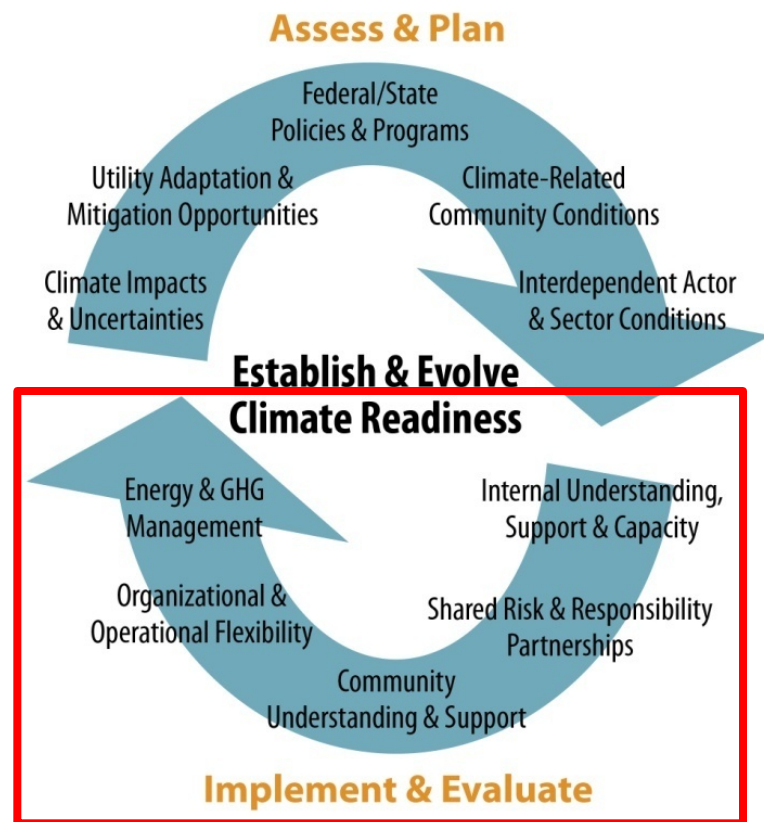
**Building out the Concept of
Climate Ready**

Climate Ready Adaptive Response Framework



STAGE 1: Assess and Plan

- Impacts and uncertainties
- Utility experience
- Federal/State policies and programs
- Climate-related community conditions
- Critical interdependent sector conditions



STAGE 2: Implement and Evaluate

- Community understanding and support
- Shared risk and responsibility partnerships
- Internal understanding, support, and capacity
- Organizational and operational flexibility
- Energy and greenhouse gas management

Avoid making large, long-term investments that do not consider and reflect climate change

-From Adaptive Response Framework

- Incorporate climate into existing utility practices
 - Asset management
 - Emergency Response Planning
 - Capital Improvements
 - Capacity Building
 - Supply/Demand Planning



Climate Resilience Evaluation & Awareness Tool

(CREAT) – Risk assessment tool designed to build climate change knowledge and support adaptation planning in the water sector.

Adaptation Strategies Guide – Collection of briefs outlining the potential impacts of climate change and effective adaptation options.

CRWU Toolbox – Searchable resource containing information to support the “Climate Ready” process.

Joint Project with Climate Ready Estuaries – Explore relationships between discharging utilities and estuaries

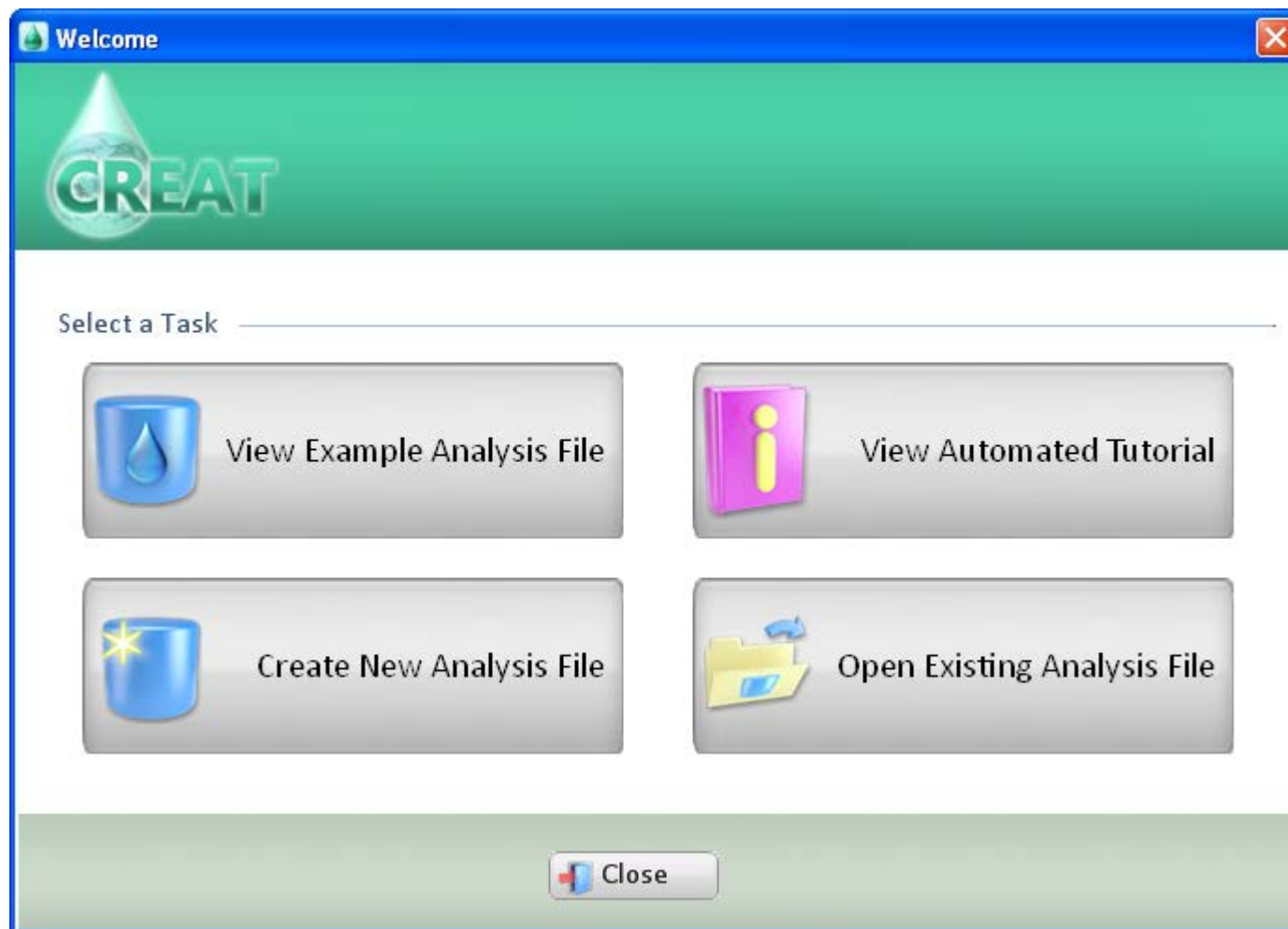
Table Top Exercise Tool – Scenario-based planning exercises for water utilities



Climate Resilience Evaluation & Awareness Tool (CREAT)

Overview

Welcome Screen





Home



The Climate Resilience Evaluation and Awareness Tool (CREAT) is a risk assessment application for water, wastewater, and combined utilities of all sizes. It helps water and wastewater utility owners and operators in understanding potential climate change threats and in assessing the related risks at their individual utilities.



Setup

CREAT captures a variety of information about your utility, including size and ownership structure. You also specify other options used during analysis.



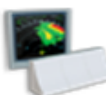
Assets

CREAT provides a standardized list of assets. You can modify the asset inventory to reflect your specific facility (wastewater, water, or water-wastewater).



Threats

CREAT provides a set of descriptive narratives regarding climate change impact and potential threats associated with them. You can select the threats applicable to your utility and define custom ones.



Adaptive Measures

Build a list of adaptive measures that are applicable to your utility. You can copy these from the provided library or create them from scratch. You should specify existing as well as planned measures.



Baseline Analysis

After establishing your initial facility setup, you can determine your current risk level associated with asset/threat combinations over the specified time periods.



Resilience Analysis

After conducting a baseline analysis, you can move forward and consider potential adaptations to your facility to lower the risk associated with specific asset/threat combinations.



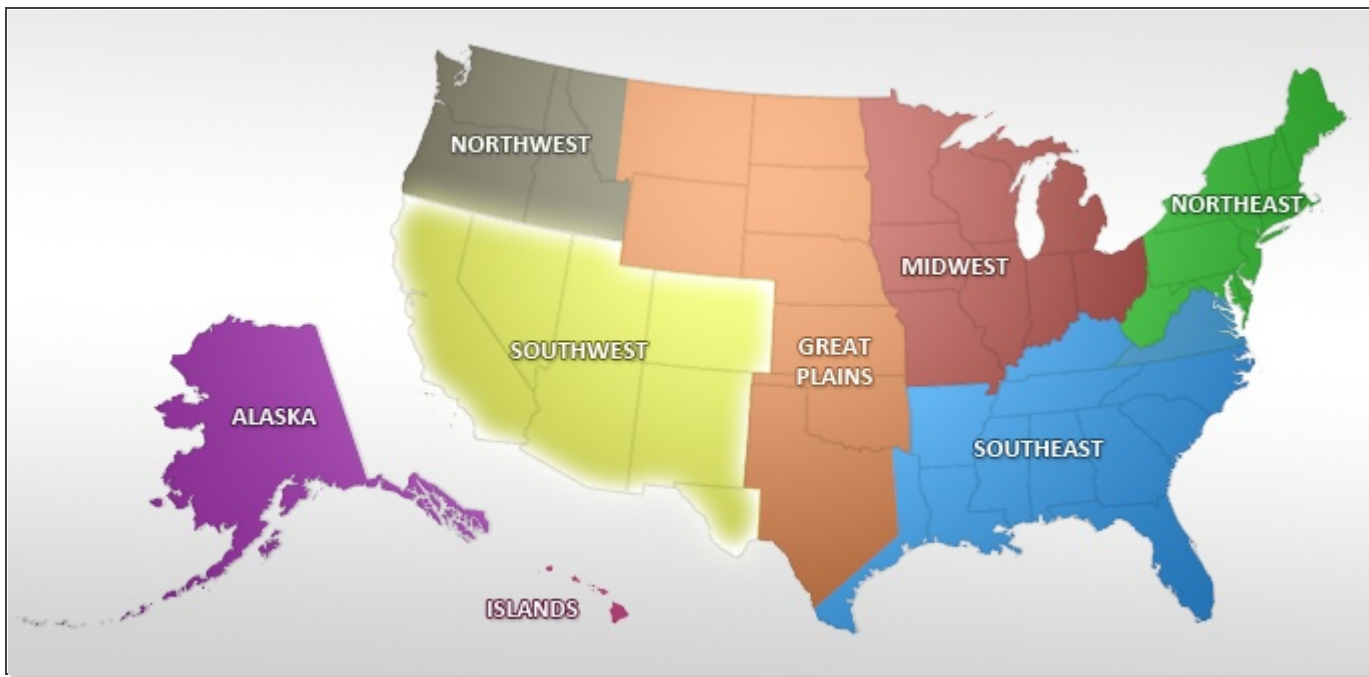
Implementation Planning

Use the Implementation Planning module to develop packages of adaptive measures that you may consider for implementation over future time horizons.



Results & Reports

Generate reports of the analysis results developed around your inventories of assets, threats, time periods, or various sorting of any analysis you have conducted.



**National and
regional
climate change
descriptions**



**Climate-related
threat
descriptions**



**Preliminary
adaptation
libraries**

Climate Information

Regions

National

Northeast

Southeast

Midwest

Great Plains

Southwest

Northwest

Alaska

Islands

Coasts

Threat Types

Back

Projected Global Sea Level Rise...

Projected Temperature and Precipitation...

Region: Coasts

Climate change projected for the Coastal region will continue trends that are already observable. The types of threats expected are highlighted in the tabs to right. As summarized in GCRP (2009), by late this century under a higher emissions scenario (IPCC SRES A2):

- Coastal waters are very likely to continue to warm by as much 4 to 8°F in this century, both in summer and winter
- Higher water temperatures and ocean acidification due to increasing atmospheric carbon dioxide
- Rising sea level is already eroding shorelines, drowning wetlands, and threatening the built environment
- Significant sea-level rise and storm surge will adversely affect coastal cities and ecosystems around the nation; low-lying and subsiding areas are most vulnerable
- Recent estimates of global sea level rise substantially exceed the IPCC estimates, suggesting sea-level rise between 3 and 4 feet in this century
- Sea-level rise is expected to increase saltwater intrusion into coastal freshwater aquifers, making some unusable without desalination
- More spring runoff and warmer coastal waters will increase the seasonal reduction in oxygen
- It is likely that hurricane rainfall and wind speeds will increase in response to global warming
- Significant sea-level rise and storm surge will adversely affect coastal cities and ecosystems around the nation; low-lying and subsiding areas are most vulnerable
- Coastal dead zones in places such as the northern Gulf of Mexico and the Chesapeake Bay are likely to increase in size and intensity
- Warming [of water temperatures] also opens the door to invasion by species that humans are intentionally or

Related Information:

Reduced Groundwater Recharge

Lower Lakes and Reservoir Levels

Reduced Snowpack

Other Drought Impacts

Saline Intrusion Into Aquifers

Altered Surface Quality

High Flow Events

Coastal Storm Surges

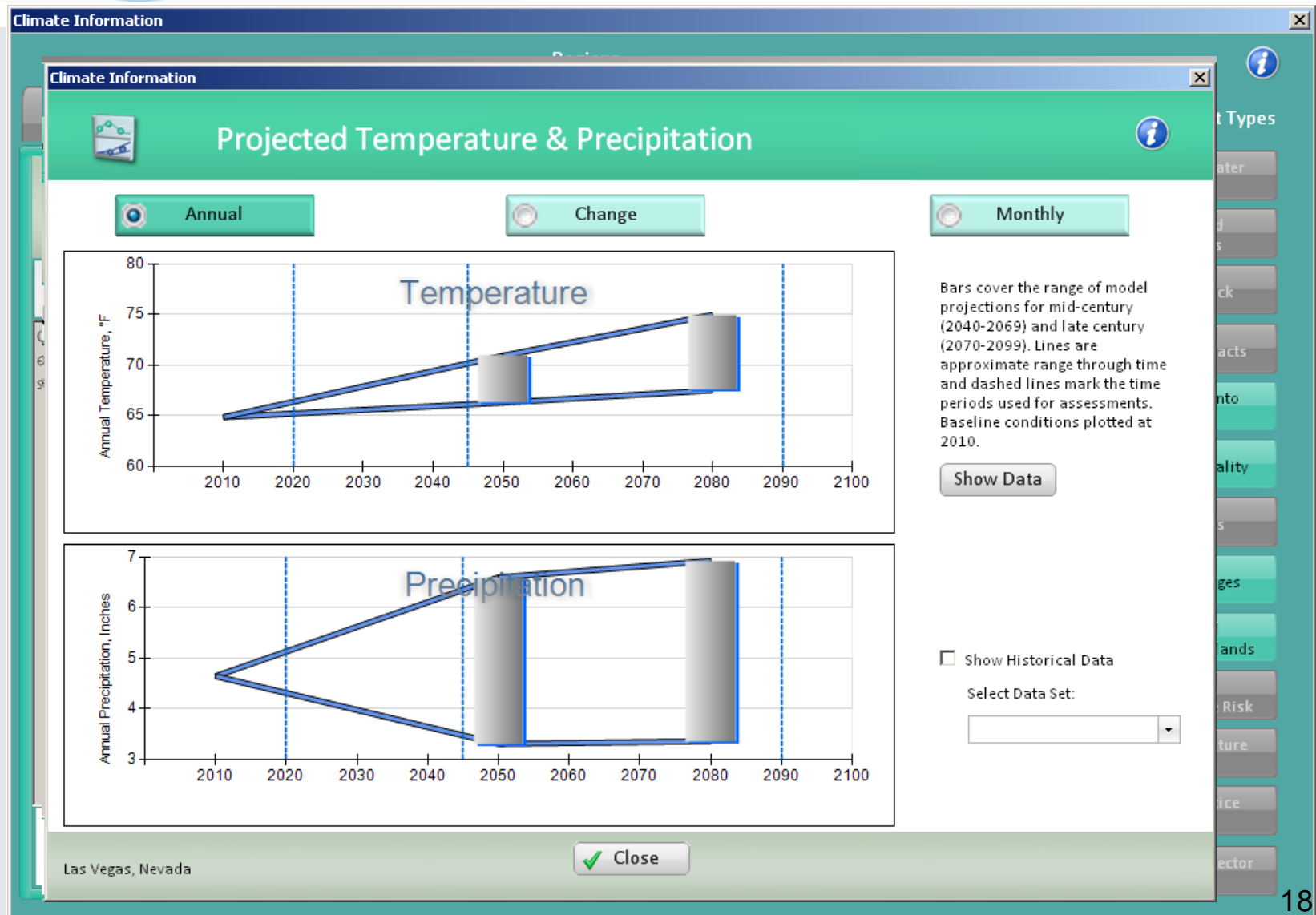
Loss of Coastal Landforms and Wetlands

Altered Vegetation/Wildlife Risk

Volume & Temperature Challenges

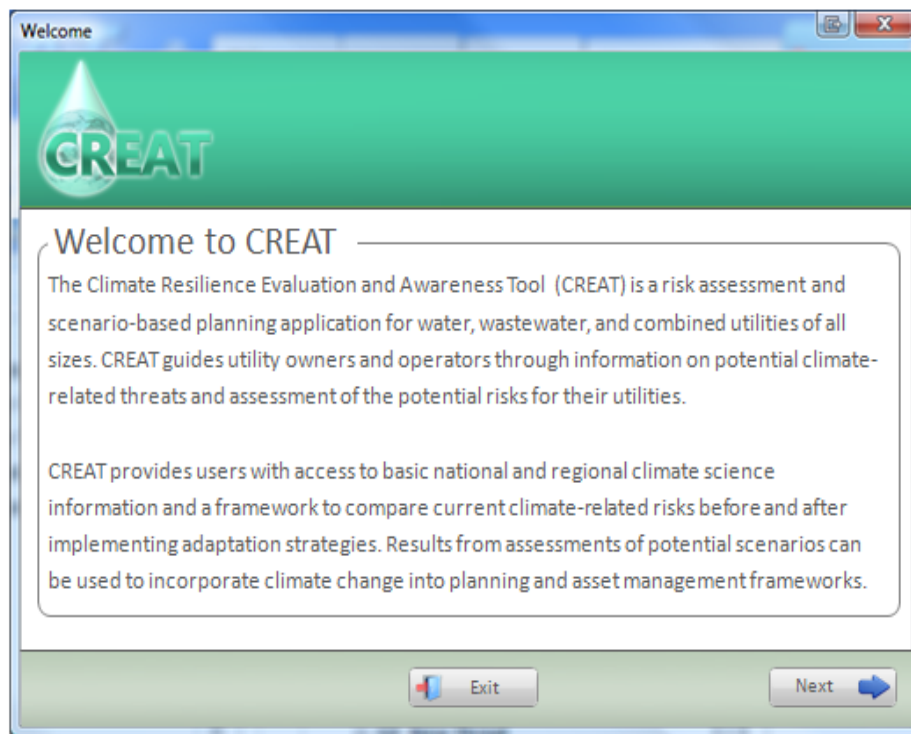
Agricultural Practice Changes

Changes in Energy Sector Water Needs



Outreach and Training

- Software is available at:
<http://water.epa.gov/infrastructure/watersecurity/climate/creat.cfm>
- Training and Outreach
- CREAT version 2.0
 - Energy Efficiency
 - Extreme Weather Data
 - Scenario-Based Planning



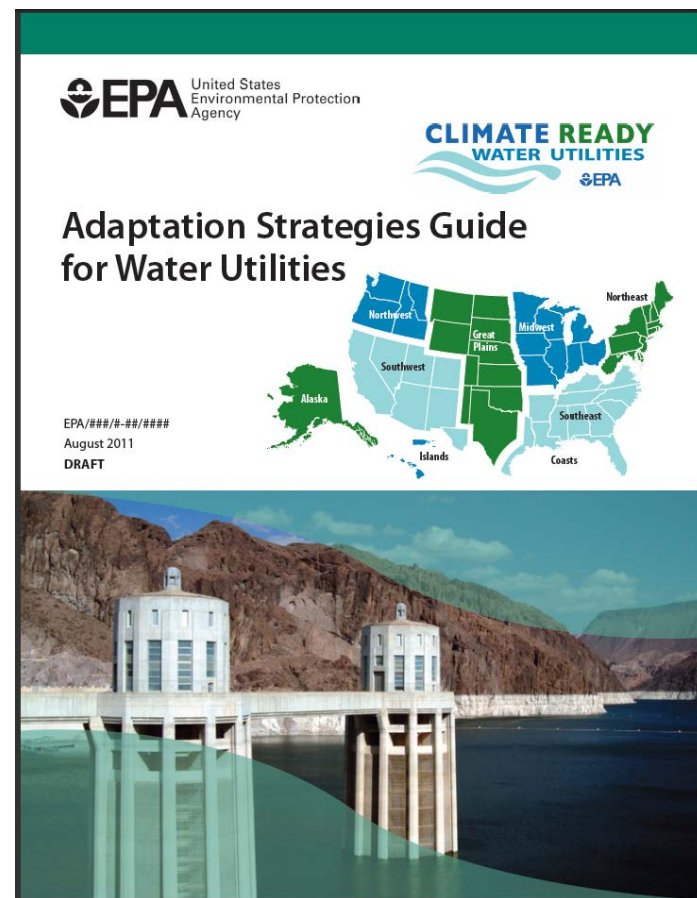


Adaptation Strategies Guide

Promoting a Clear Understanding
of Adaptation Options



ASG Overview

- Guide for drinking water and wastewater utilities that have not begun to consider climate change in utility planning
- Navigate guide like a website
- Goals:
 - Present easy-to-understand climate science
 - Translate science into impacts to utilities
 - List adaptation strategies related to impacts
 - Assist in the adaptation planning process



- Introduction & What is Adaptation Planning?
- Select from three types of briefs:
 - Regional
 - Challenge Group
 - Challenge
- Adaptation Planning Worksheet
- Glossary

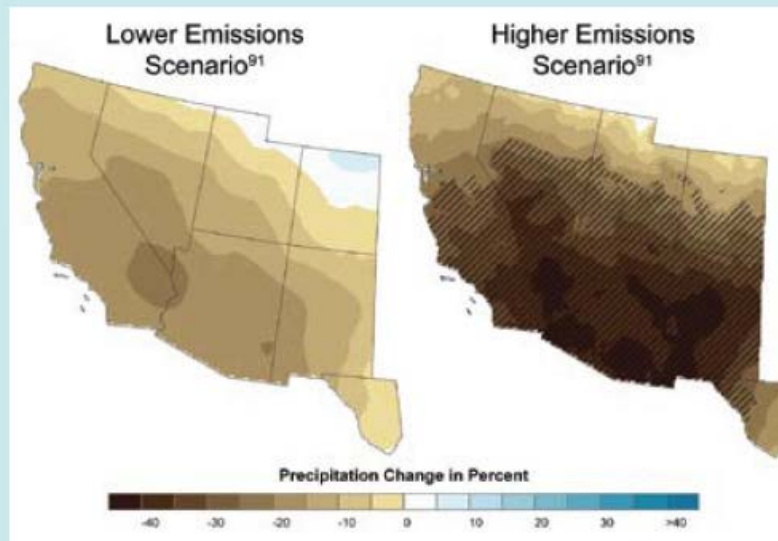
PROJECTED CHANGES

CHALLENGES BY GROUP		DW	WW
Int	Reduced groundwater recharge		
	Increased groundwater pumping		

EXAMPLE

Projected Change in Spring Precipitation 2080–2090: Percentage change in March–April–May precipitation for 2080–2099 compared to 1961–1979 for a lower emissions scenario (left) and a higher emissions scenario (right). Confidence in the projected changes is highest in the hatched areas.

SOURCES Hayhoe et al. 2004; Hayhoe et al. 2008; USGCRP 2009.





Climate Challenge Group: SERVICE DEMAND & USE (DW/WW/W) [Return to Introduction](#)

• Challenge Summaries

ADAPTION OPTIONS


Click to left of name to check off options for consideration; \$'s indicate relative costs

Click name of any option to review more information in the Glossary



No Regrets options - actions that would provide benefits to the utility under current climate conditions as well as any future changes in climate. For more information on No Regrets options, see Page 6 in the Introduction.

✓	PLANNING	COST
	Develop models to understand potential water quality changes (e.g., increased turbidity or eutrophication) and costs of resultant changes in treatment.	\$
	Model sewer systems to understand the impact of higher groundwater infiltration on plant capacity and operating costs.	\$
	Use hydrologic models to project runoff and incorporate model results during water supply planning.	\$
	Plan for alternative power supplies to support operations in case of loss of power.	\$-\$
	Conduct climate change impacts and adaptation training for personnel.	\$

Develop energy management plans for key facilities.	\$
 Participate in community planning and regional collaborations related to climate change adaptation.	\$-\$
Update drought contingency plans.	\$
Establish a relationship with the local power utility and work jointly on strategies to reduce seasonal or peak water and energy demands (e.g., water reclamation for use in power generation).	\$
Work with power companies to evaluate feasibility of using recycled water or alternative cooling methods to meet power plant needs.	\$

Continued on page 2

Challenge Briefs



VOLUME & TEMPERATURE CHALLENGES (DW)

[Return to Introduction](#)

Drought may increase in frequency and severity in some areas due to projected declining precipitation and increased evapotranspiration. In areas dependent on snowpack, higher temperatures will reduce snowpack and can decrease water storage. This combination results in decreased streamflow, reservoir safe yield, and groundwater recharge. These impacts will reduce the available supplies for water systems dependent on surface water as well as groundwater, and potentially lead to service disruption. Diversifying water sources addresses some challenges associated with increased temperature, such as increased treatment costs associated with declining surface water quality. Groundwater often requires less treatment than surface water, and water recycling reduces the total amount of water that needs to be treated (Miller and Yates 2005).

- Climate information

- List of

CLIMATE INFORMATION

- Model projections of future precipitation indicate that southern areas, particularly the Southwest, will become drier. Some parts of the Southwest are projected to have decreases in spring and winter precipitation of greater than 20% and 40%, respectively. The Pacific Northwest may experience declines in summer precipitation of greater than 30% (USGCRP 2009).
- By the end of the century, the average U.S. temperature is projected to increase by approximately 7–11 °F under the higher emissions scenario and by approximately 4–6.5 °F under the lower emissions scenario (USGCRP 2009). By the end of the century, in North America, the 1 in 20 year hot day is expected to become at least a 1 in 3 year event.

Monitor current weather conditions including precipitation and temperature.	\$
Monitor surface water conditions including streamflow and water quality.	\$
Finance and facilitate systems to recycle water including use of greywater in homes and businesses.	\$\$-\$\$\$
Practice conjunctive use (i.e., optimal use of surface and groundwater).	\$\$-\$\$\$
Reduce agricultural and irrigation water demand by working with irrigators to install advanced equipment (e.g., drip or other micro-irrigation systems with weather linked controls).	\$\$-\$\$\$
Practice water conservation and demand management through water metering, rebates for water conserving appliances/toilets and/or rainwater harvesting tanks.	\$-\$\$

Challenge Briefs

EXAMPLE

The Metropolitan Water District of Southern California (Metropolitan) is a wholesale water supplier for southern California. Metropolitan improved its Integrated Resource Plan in 1996 to enhance and diversify water supply reliability. Over the past decade, imported water supplies have been complemented by aggressive conservation programs, local water recycling, groundwater supplies, enhanced water storage, and conveyance and water transfers. Metropolitan has helped develop more than 75 water recycling and groundwater recovery programs with local agencies through funding incentives. For example, the West Basin Municipal Water District receives secondary, treated wastewater from the City of Los Angeles, treats it to a tertiary level, and delivers it primarily for landscape irrigation and various industrial purposes. A portion of this water is injected to create an exclusion barrier against seawater intrusion into drinking water wells in the South Bay area. This project currently produces more than 20,000 acre-feet of water each year and is expected to expand to around 70,000 acre-feet of water each year by 2025. Moreover, Metropolitan has increased its storage capacity tenfold through the completion of both the Diamond Valley Lake in Hemet, new groundwater storage, and by acquiring contractual storage in state reservoirs. It has also been a leader in voluntary water transfers with agricultural districts. In August 2004, Metropolitan and the Palo Verde Irrigation District (PVID) executed a 35-year agreement under which individual landowners agree not to irrigate up to 29% of the valley's farm land, saving up to 111,000 acre-feet for other uses (Metropolitan 2010).

- Utility case study

Adaptation Worksheet

Adaptation Strategies Guide for Water Utilities WORKSHEET FOR ADAPTATION PLANNING

Identify thresholds for failure and damage

Note specific utility assets and water resources where any damage or loss would impair meeting your utility's mission

Name _____

Type DW ☐ WW ☐ SW ☐

Region _____ Coasts ☐

Example

Example

Climate-related Challenges

Select those challenges that are of concern to your utility

Challenge Group: Drought

- ☐ Reduced ground water recharge
- ☐ Lower lake and reservoir levels
- ☐ Changes in seasonal runoff & loss of snowpack

Challenge Group: Water Quality Degradation

- ☐ Low flow conditions and altered water quality
- ☐ Saltwater intrusion into aquifers
- ☐ Altered surface water quality

Challenge Group: Floods

Challenge Group: Ecosystem Changes

- ☐ Loss of coastal landforms / wetlands
- ☐ Increased fire risk & altered vegetation

Challenge Group: Service Demand and Use

- ☐ Volume & temperature challenges
- ☐ Changes in agricultural water demand
- ☐ Changes in energy sector needs
- ☐ Change in energy needs of utilities

Page 19

Understand projected impacts and challenges

Determine adaptation options

implementing to reduce the consequences of climate change at your utility

Example

Example

Elements of a Proposed Adaptation

Year for completion

Threshold conditions

Limitations

Potential collaborators

Priorities (select)

- ☐ Adaptation option type
- ☐ Cost of adaptation
- ☐ Timing of action
- ☐ Vulnerability assessment
- ☐ Assets impacted
- ☐ Other:

Implement and monitor

Page 20

• Categorizes

ECOSYSTEM & LAND USE



Acquire and manage ecosystems \$\$\$ – Intact natural ecosystems have many benefits for utilities: reducing sediment and nutrient inputs into source water bodies, regulating runoff and streamflow, buffering floods, and reducing storm surge impacts and inundation on the coasts (e.g. mangroves, saltwater marshes, wetlands). Utilities could also work with regional floodplain managers and appropriate stakeholders to explore non-structural flood management techniques in the watershed. Protecting, acquiring, and managing ecosystems in buffer zones along rivers, lakes, reservoirs, and coasts can be cost-effective measures for flood control and water quality management.

Im

etrofit

Water Use
& Demand

Implement green infrastructure on site and in municipalities \$\$\$ – Green infrastructure can help reduce runoff and stormwater flows that may otherwise exceed system capacity. Examples of green infrastructure include: bio-retention areas (rain gardens), low impact development methods, pervious pavement, green roofs, swales (depressions to capture water), and the use of vegetation or pervious materials instead of impervious surfaces.

Implement watershed management \$\$ – Watershed management includes a range of policy and technical measures. These generally focus on preserving or restoring vegetated land cover in a watershed and managing stormwater runoff. These changes help mimic natural watershed hydrology, increasing groundwater recharge, reducing runoff, and improving the quality of runoff.

• ID No-Regrets



CRWU Toolbox

Resources for Planning a
Response to Climate Change

CRWU Toolbox

- Searchable database for utilities to obtain resources related to climate change and water
- Searches by utility attributes, climate concerns, and response strategies selected by the user
- Current version contains over 500 resources
 - Publications
 - Current activities
 - Funding opportunities
 - Events
 - Tools and models



Water Security



Contact Us Search: ☐ All EPA ☒ This Area

You are here: [EPA Home](#) » [Water](#) » [Ground Water & Drinking Water](#) » [Water Security](#) » [Climate Ready Water Utilities](#) » CRWU Toolbox

Climate Ready Water Utilities Toolbox



The CRWU Toolbox provides access to resources containing climate-related information relevant to the Water Sector. These resources include several categories of information and can be searched by geographic region, water utility type and size, water resources, climate change impact, and climate change response strategies. These resources will be updated frequently to provide the most current Water Sector climate change information.

This page provides links to non-EPA web sites that provide additional information about Climate Ready Water Utilities. You will leave the EPA.gov domain and enter another page with more information. EPA cannot attest to the accuracy of information on that non-EPA page. Providing links to a non-EPA Web site is not an endorsement of the other site or the information it contains by EPA or any of its employees. Also, be aware that the privacy protection provided on the EPA.gov domain (see [Privacy and Security Notice](#)) may not be available at the external link. [EXIT Disclaimer](#)



Featured Resource



Region Map



Activities



Funding



Publications and Reports



Tools and Models



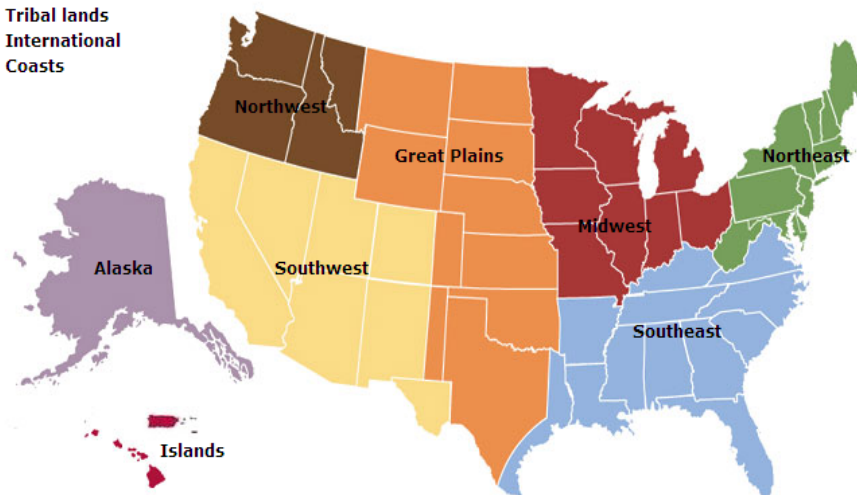
Training, Workshops & Seminars



Mitigation Strategies


Select a Region

Tribal lands
International
Coasts



Features:

- Browse by Tabs
- Region Map
- Highlighted Resources
- Link Direct to Web Page
- Option to Show Searchable Database/Resources List



Which categories of information would you like to search?

☐ Activities

☐ Funding

☐ Publications
and Reports

☐ Tools and
Models

☐ Training,
Workshops
and Seminars

Who are you?

Region	Utility Type	Utility Size
<input type="button" value="Select All"/>	<input type="button" value="Select All"/>	<input type="button" value="Select All"/>
<input type="checkbox"/> Not Region Specific <input type="checkbox"/> Northeast <input type="checkbox"/> Southeast <input type="checkbox"/> Midwest <input type="checkbox"/> Great Plains <input type="checkbox"/> Northwest	<input type="checkbox"/> Southwest <input type="checkbox"/> Alaska <input type="checkbox"/> Islands (HI/PR) <input type="checkbox"/> Tribal lands <input type="checkbox"/> Coastal areas <input type="checkbox"/> International	<input type="checkbox"/> Not Type Specific <input type="checkbox"/> Drinking Water <input type="checkbox"/> Storm Water <input type="checkbox"/> Wastewater <input type="checkbox"/> Combined
		<input type="checkbox"/> Not Size Specific <input type="checkbox"/> Small (up to 3300) <input type="checkbox"/> Medium (3301 - 10000) <input type="checkbox"/> Large (10001 - 100000) <input type="checkbox"/> Very Large (100000 or more)

What are your concerns?

Climate Impact	Water Resource Type
<input type="button" value="Select All"/>	<input type="button" value="Select All"/>
<input type="checkbox"/> Sea level <input type="checkbox"/> Temperature <input type="checkbox"/> Precipitation <input type="checkbox"/> Storm frequency & intensity <input type="checkbox"/> Seasonal hydrology <input type="checkbox"/> Glacial / snow pack melt <input type="checkbox"/> Evaporation	<input type="checkbox"/> Droughts <input type="checkbox"/> Floods <input type="checkbox"/> Source & receiving water quality <input type="checkbox"/> Ecosystems <input type="checkbox"/> Competing water uses <input type="checkbox"/> Public health

How do you want to respond?

☐ Groundwater
☐ Surface water
☐ Desalinated water
☐ Reclaimed water

☐ Mitigation
☐ Adaptation

- Search function
- Choose:
 - Region
 - Utility type & size
 - Climate concerns
 - Water resource
 - Climate response
- Tailored resource list

www.amwa.net/galleries/climate-change/CUWA_CChangeReport12_2007.pdf

Climate Change and Urban Water Resources

INVESTING FOR RELIABILITY

Climate Ready Water Util... www.amwa.net/galle... CRWU ASG challenge VO... ASG October 2011 DRAF... Desktop

1:45 PM Wednesday

Climate Change This report draws conclusions about the vulnerability of the United States as a whole and the relative vulnerability of different regions, economic sectors, and natural ecosystems. Among the impacts of

Show Results



Want more information?

CRWU website:

<http://water.epa.gov/infrastructure/watersecurity/climate/>

Sign up for e-newsletters:

EPA Climate Change and Water News: Send a blank email to water_and_climate_change_listserve-subscribe@lists.epa.gov

EPA climate change activities:

<http://epa.gov/climatechange>



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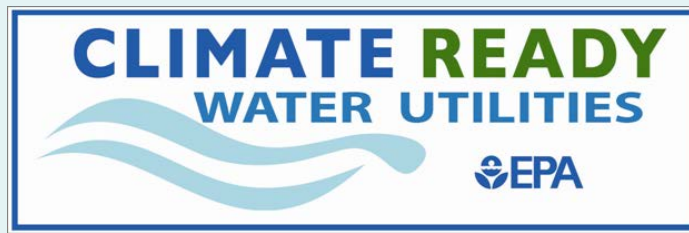
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Water Smart Innovations

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