Smart Management for Small Water Systems

From Emergency Management to Building Resilience: A Workshop for Small Water Systems

Thursday, November 1, 2018 | Wichita, Kansas

www.efcnetwork.org

Wichita State University
Hugo Wall School of Public Affairs
Environmental Finance Center

University of Maryland Environmental Finance Center

EFCN environmental finance center network

NADO National Association of Development Organizations Research Foundation

Government Finance Officers Association

This program is made possible under a cooperative agreement with the U.S. EPA.

CEU Certificates

If you need a CEU certificate, you will need to confirm the following on the roster today before you leave:

- Is your name spelled correctly?
- Did you provide an email address UNIQUE TO YOU? A unique email address is required to receive your certificate.
- Did you mark the checkbox that you need a certificate?

Within 30 days of the training, you will receive an email with instructions to print your certificate. Emails from EFCN may be blocked or go to your Junk mail. To avoid this issue, add *wwwhipps@syr.edu* to your email Contacts or check your Junk mail frequently.

EFCN will apply to the water operator state licensing agency for CEU preapproval when applicable. You may be awarded CEUs by your agency. It is your responsibility to confirm with the agency that training meets relevancy criteria established for your license type as some agencies may not apply CEUs to your license if the training topic is not relevant to your position.

EFCN follows the IACET Standard of CEU calculation.
0.1 CEU = 1 Contact Hour or 1 Professional Development Hour

Questions? Please contact *wwwhipps@syr.edu*

About the Environmental Finance Center Network (EFCN)

The Environmental Finance Center Network (EFCN) is a university-based organization creating innovative solutions to the difficult how-to-pay issues of environmental protection and improvement. The EFCN works with the public and private sectors to promote sustainable environmental solutions while bolstering efforts to manage costs.

The Smart Management for Small Water Systems Program

This program is offered free of charge to all who are interested. The Program Team will conduct activities in every state, territory, and the Navajo Nation. All small drinking water systems are eligible to receive free training and technical assistance.

What We Offer

Individualized technical assistance, workshops, small group support, webinars, eLearning, online tools & resources, blogs

The Small Systems Program Team

- Environmental Finance Center at The University of North Carolina at Chapel Hill
- Southwest Environmental Finance Center at the University of New Mexico
- Syracuse University Environmental Finance Center
- Environmental Finance Center at Wichita State University
- EFC West
- Environmental Finance Center at the University of Maryland
- New England Environmental Finance Center at the University of Southern Maine
- Great Lakes Environmental Infrastructure Center
- Government Finance Officers Association (GFOA)
- National Association of Development Organizations (NADO)

UNC Environmental Finance Center

Southwest Environmental Finance Center

Environmental Finance Center, Syracuse University

Wichita State University, Hugo Wall School of Public Affairs, Environmental Finance Center

EFCWest, Environmental Finance Center West

University of Maryland Environmental Finance Center

New England Environmental Finance Center

Great Lakes Environmental Infrastructure Center, Environmental Finance Center for EPA Region 5

Government Finance Officers Association

NADO Research Foundation

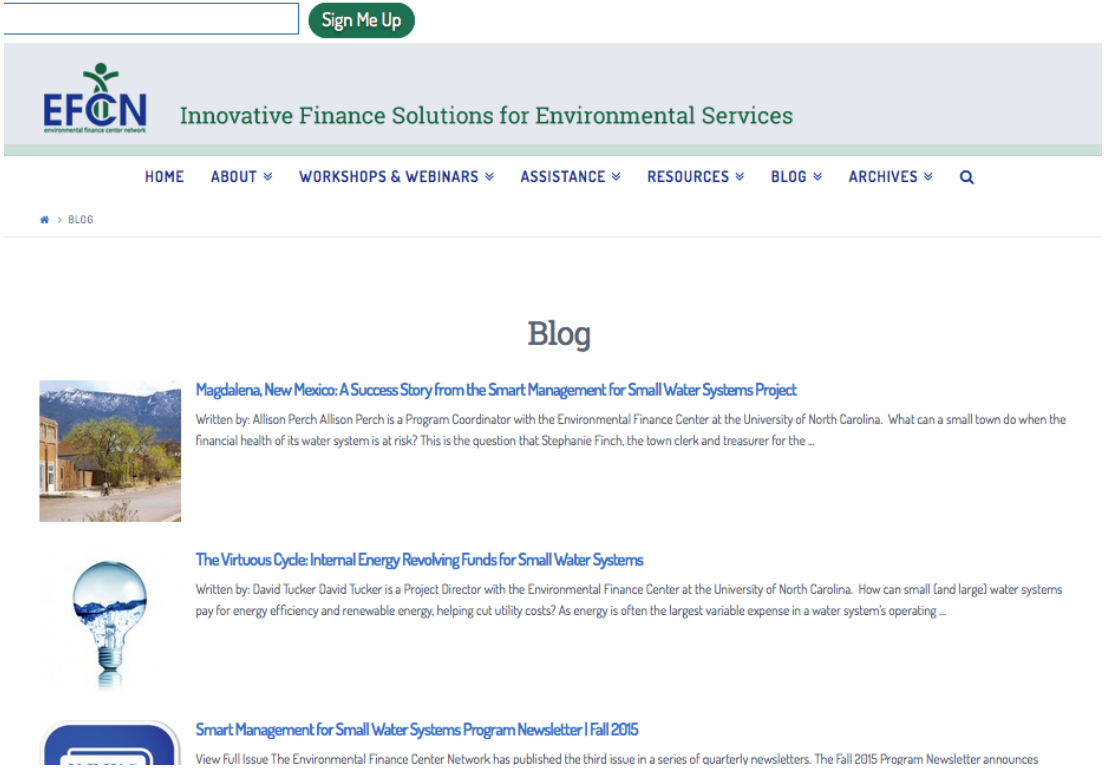
Areas of Expertise

- Asset Management
- Rate Setting and Fiscal Planning
- Communication and Decision-Making Strategies
- Water Loss Control
- Controlling Energy Costs
- Accessing Infrastructure Financing Programs
- Workforce Development
- Water Conservation Finance and Management
- Collaborating with Other Water Systems
- Resiliency Planning
- Managing Drought

Small Systems Blog

Learn more about water finance and management through our Small Systems Blog! Blog posts feature lessons learned from our training and technical assistance, descriptions of available tools, and small systems “success stories.”

efcnetwork.org/small_systems_blog/



Agenda

8:30AM – 9:00AM	Registration
9:00AM – 9:15AM	Welcome and Introductions
9:15AM – 10:00AM	Trends in Hazards, Risks and Stressors
10:00AM – 10:50AM	Planning Ahead for Impacts on Critical Infrastructure
10:50AM – 11:00AM	BREAK
11:00AM – 12:00AM	Emergency Water Supply & Demand Interactive Exercise
12:00PM – 1:00PM	LUNCH
1:00PM – 2:35PM	Local Resources and Tools • Kansas Hazard Communication Requirements
2:35PM – 2:45PM	BREAK
2:45PM – 3:45PM	Resources and Tools Continued • Mutual Aide Agreements • State Revolving Funds & Other Resources
3:45PM – 4:00PM	Wrap Up

Objectives

- How to identify threats to small water systems and their impacts and consequences.
- How to prepare for and respond to emergencies and begin planning ahead.
- How to access local resources.

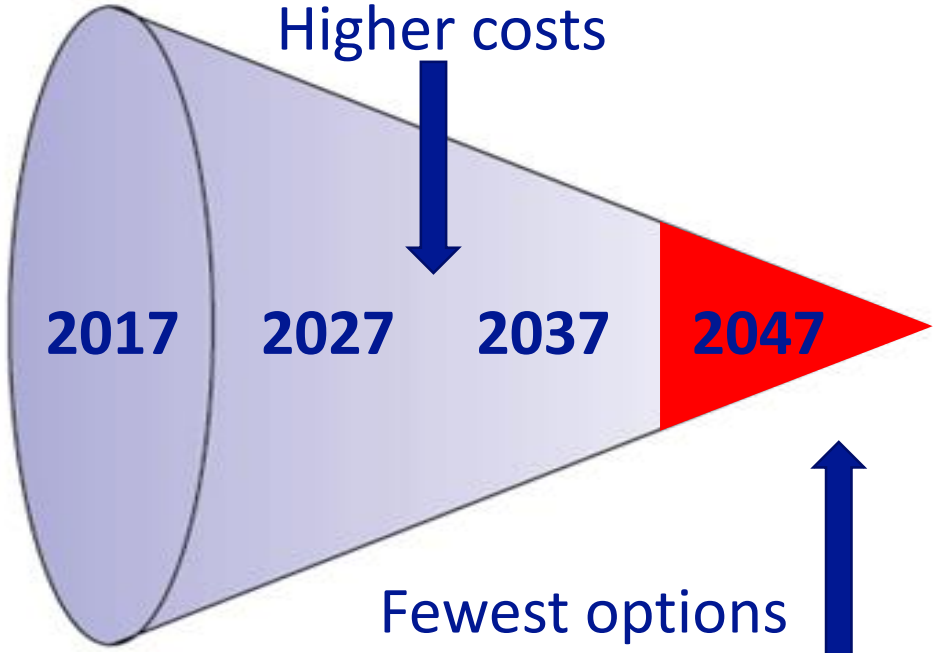
Planning For Impact

The Hard Sell

You think it is expensive now…

Fewer options
Higher costs

Multiple options
Lower costs



Fewest options
Highest costs
Including damage and recovery costs

New Orleans after Katrina- 2012

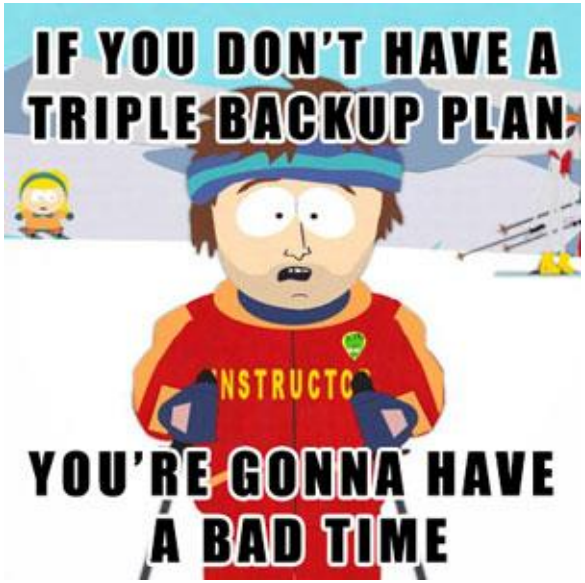

Flint Michigan - 2015

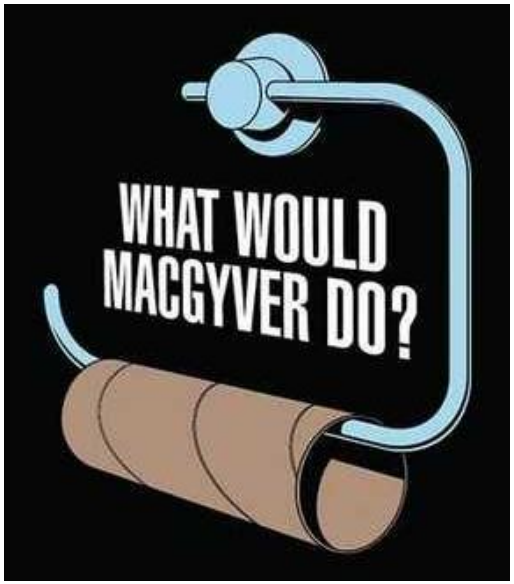
Orville Dam, California - 2016

RESILIENCY:

the ability of a person or organization to anticipate, prepare for, and respond to change and sudden disruptions in order to survive and prosper.

4 R's of Resiliency

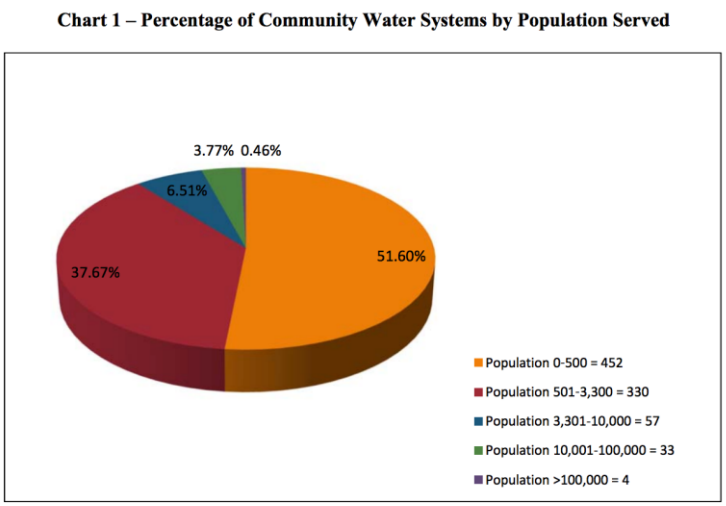




Identify Threats

STEP ONE

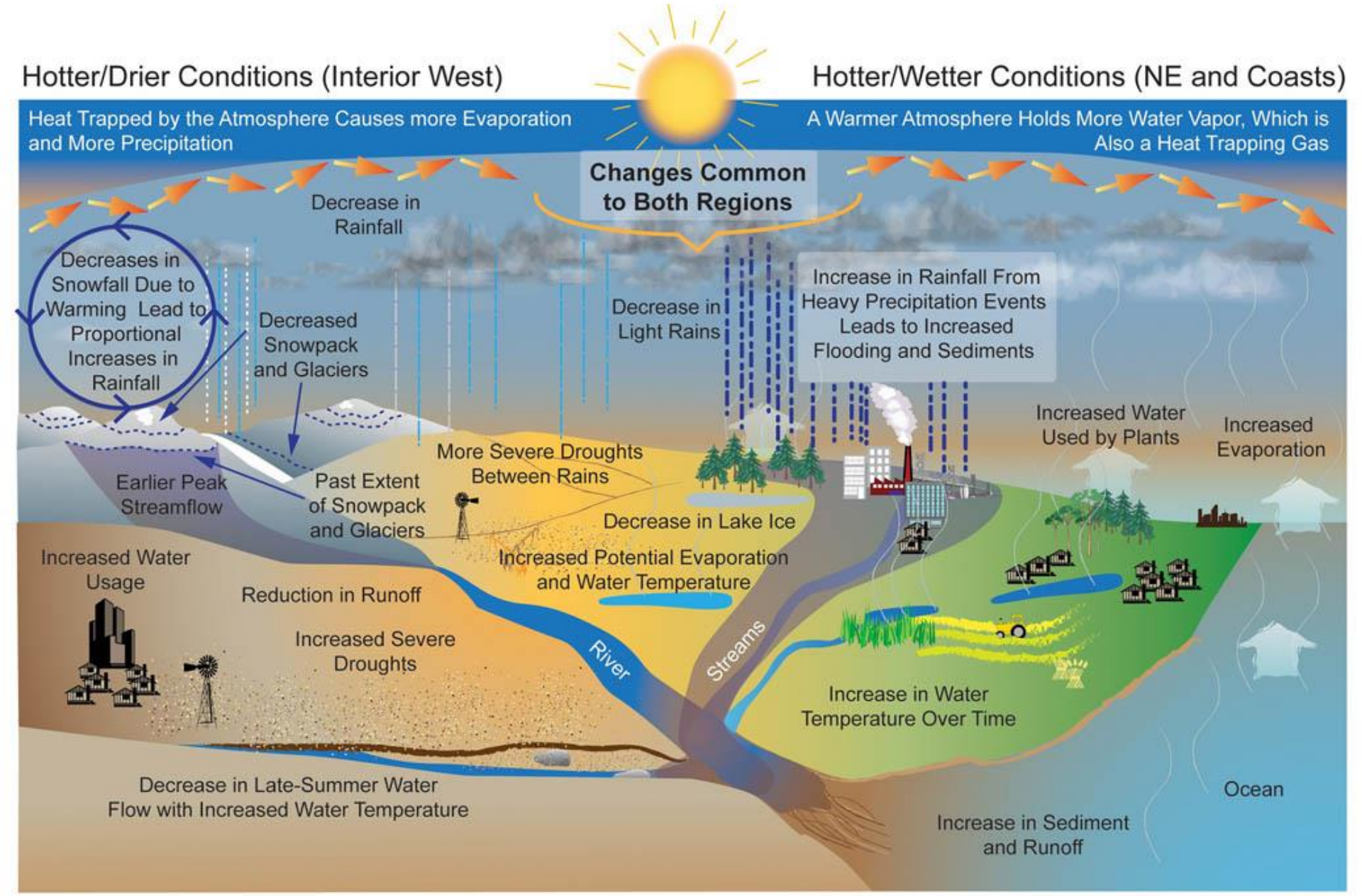
Kansas Water



- 989 public water supply systems in Kansas (2017)
  - 871 community,
  - 41 non-transient non-community,
  - 77 transient non-community systems
- 85% of water → Irrigation
- 10% → municipal use


Drought
PowerOutage
PopulationChange
ClimateChange
AgingInfrastructure
Wind
Ice
Blizzard
CyberTerrorism
BlueGreenAlgae
Tornado
Flooding
AgingWorkforce

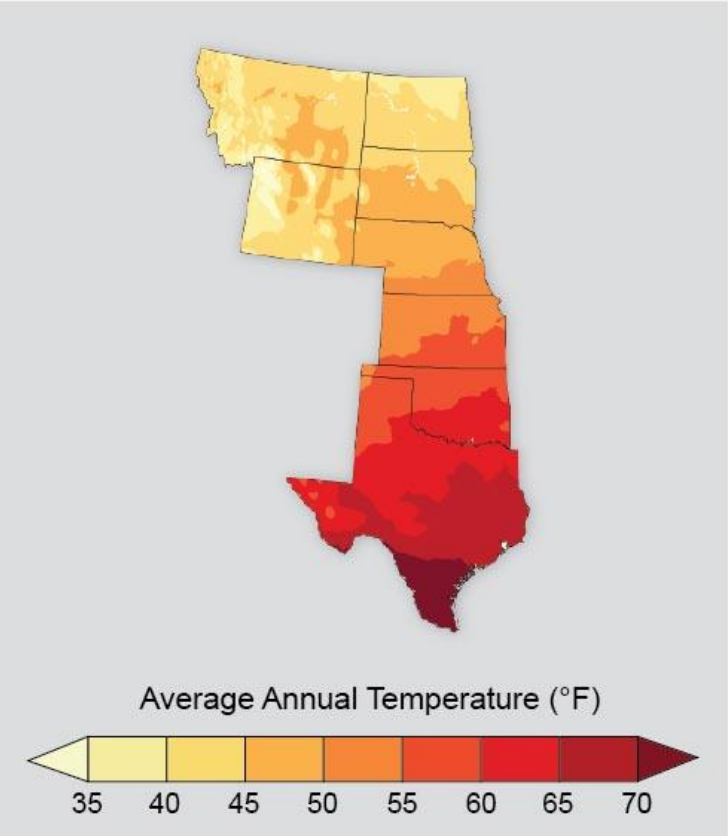
Hazard	Stressor
Acute	Chronic
Short-term damage	Slowly weakens

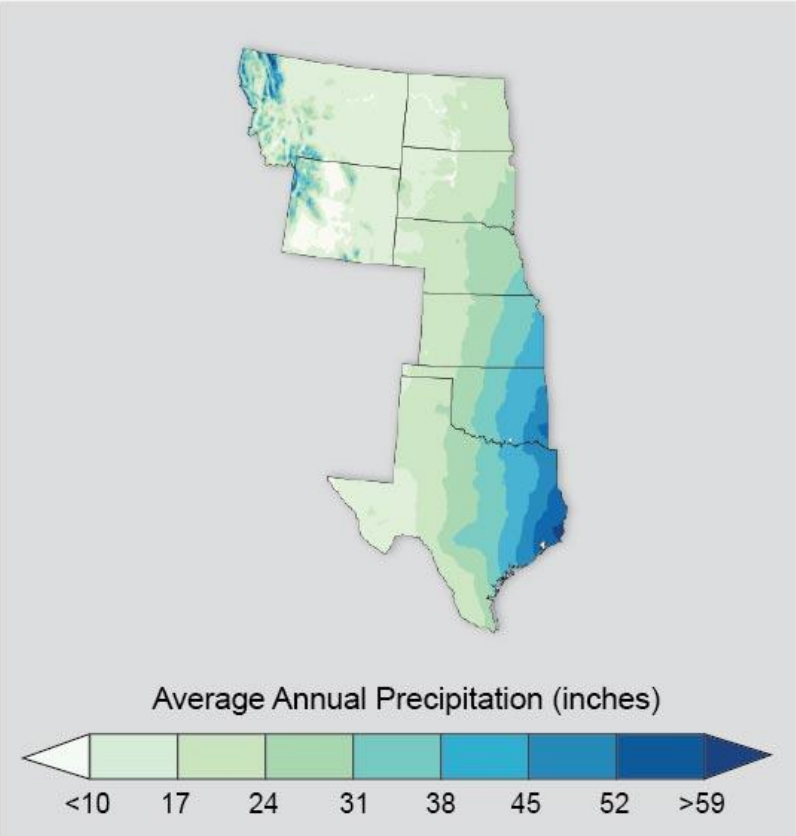


https://www3.epa.gov/climatechange/images/impacts-adaptation/WaterCycleChanges.jpg

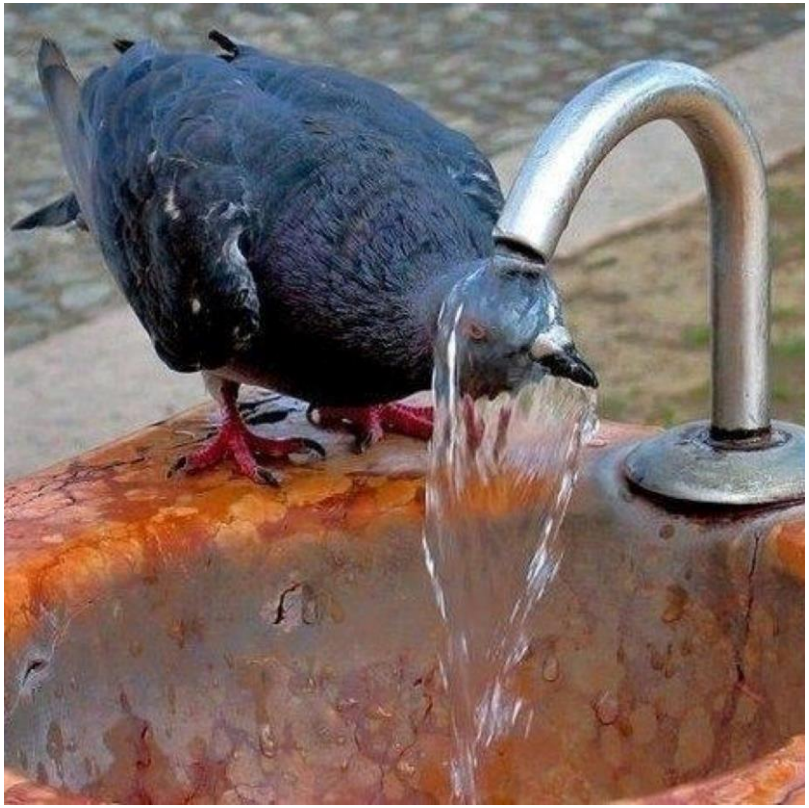
Kansas, Historically Moderate

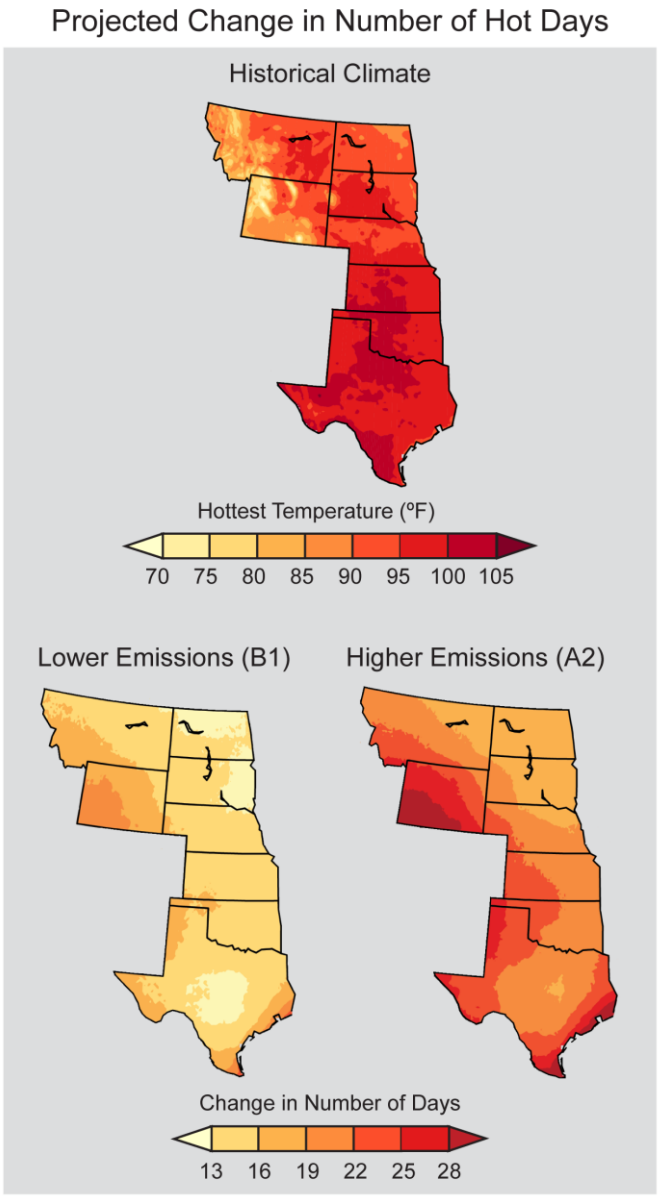
Temperature and Precipitation Distribution in the Great Plains

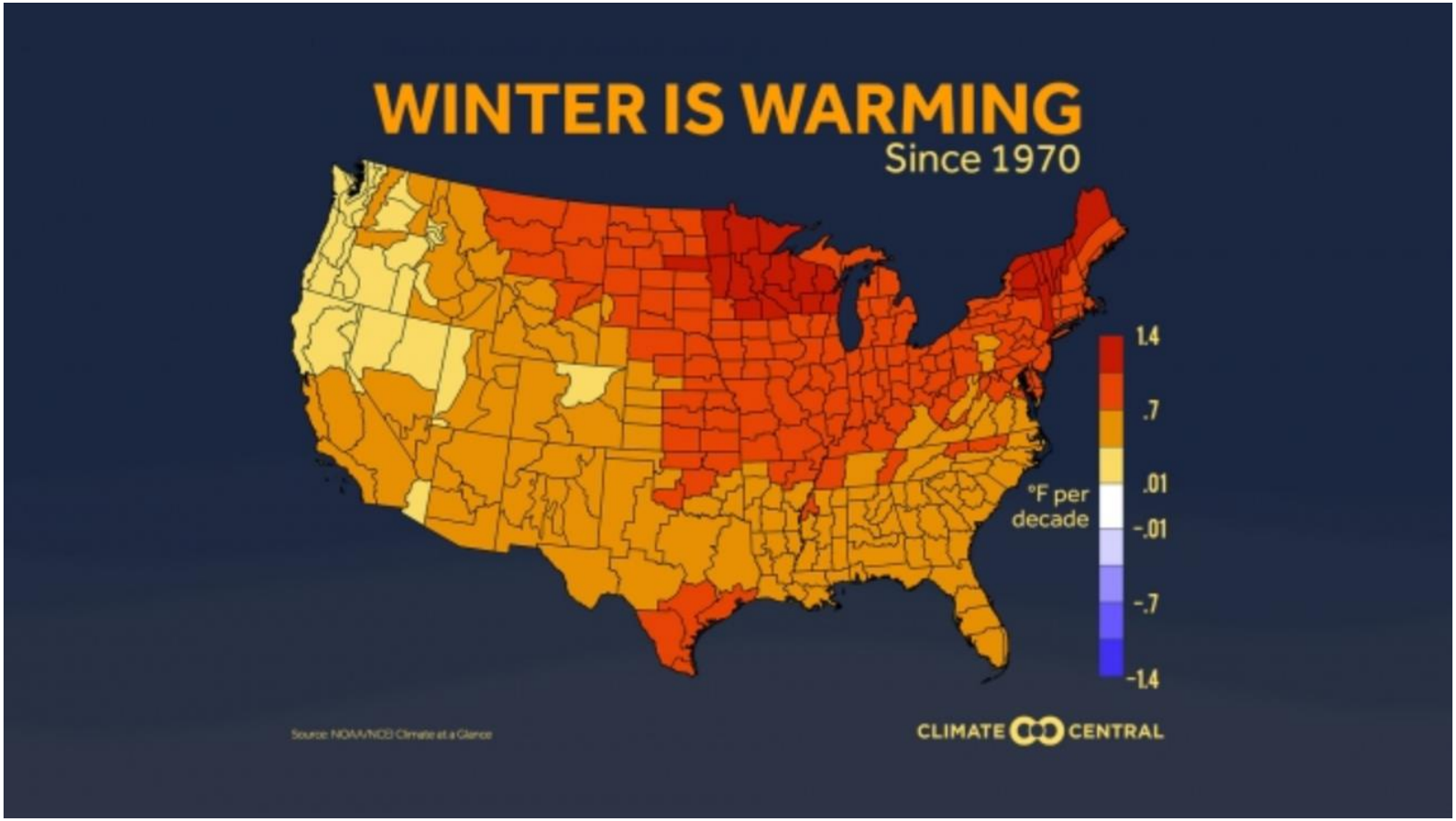




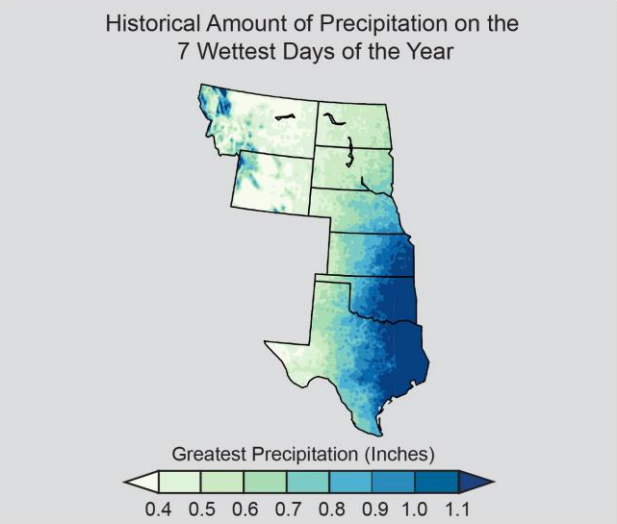
More Days Over 95 degrees

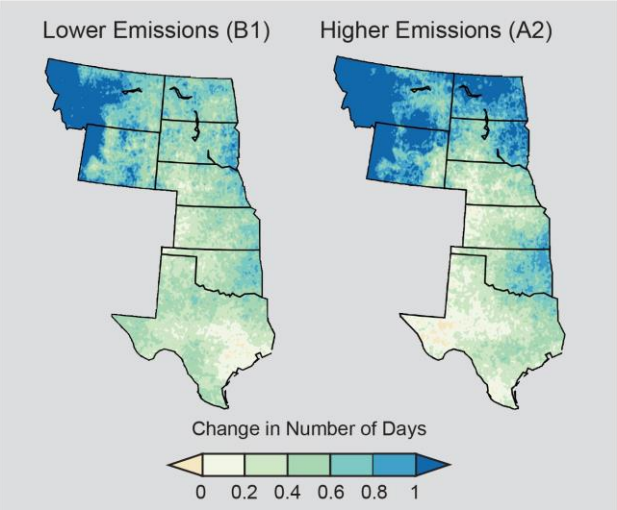





WINTER IS WARMING
Since 1970
1.4
.7
.01
-.01
-.7
-1.4
°F per decade
Source: NOAA/NCEI Climate at a Glance
CLIMATE CENTRAL

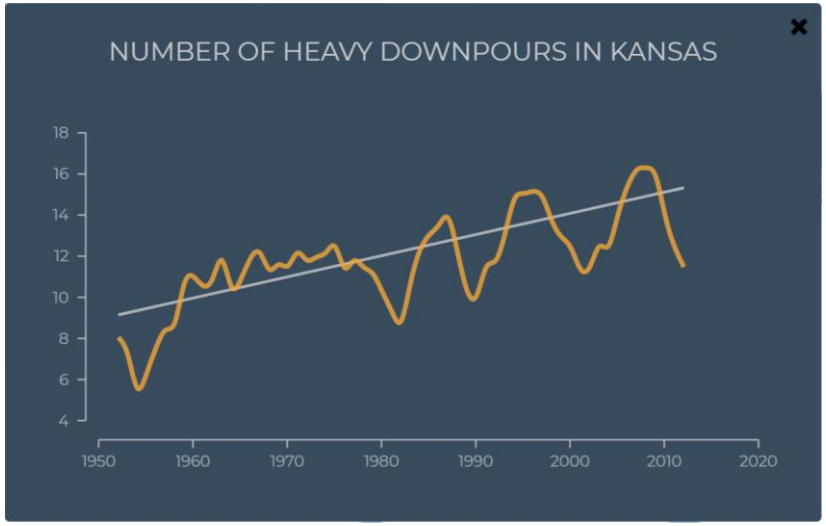
Moderate Increase in Precipitation



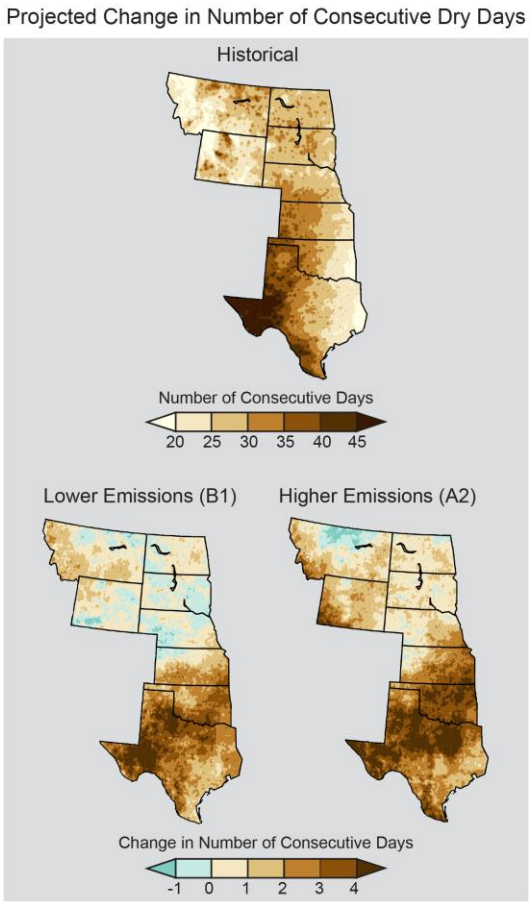


Increase in Extreme Precipitation Events

Flooded streets near Pawnee and Meridian in 2015. ***Fernando Salazar*** *File photo*



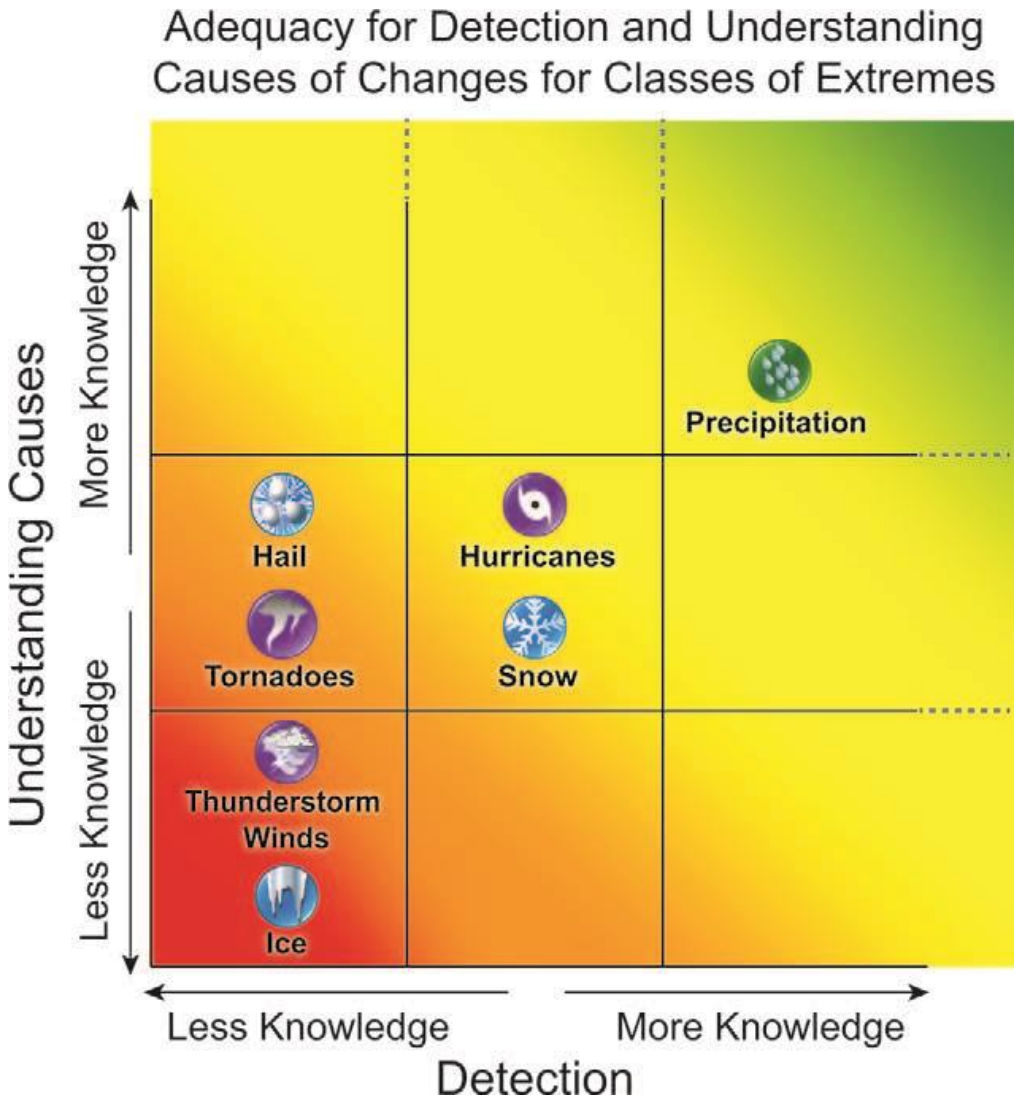
Increase in Droughts



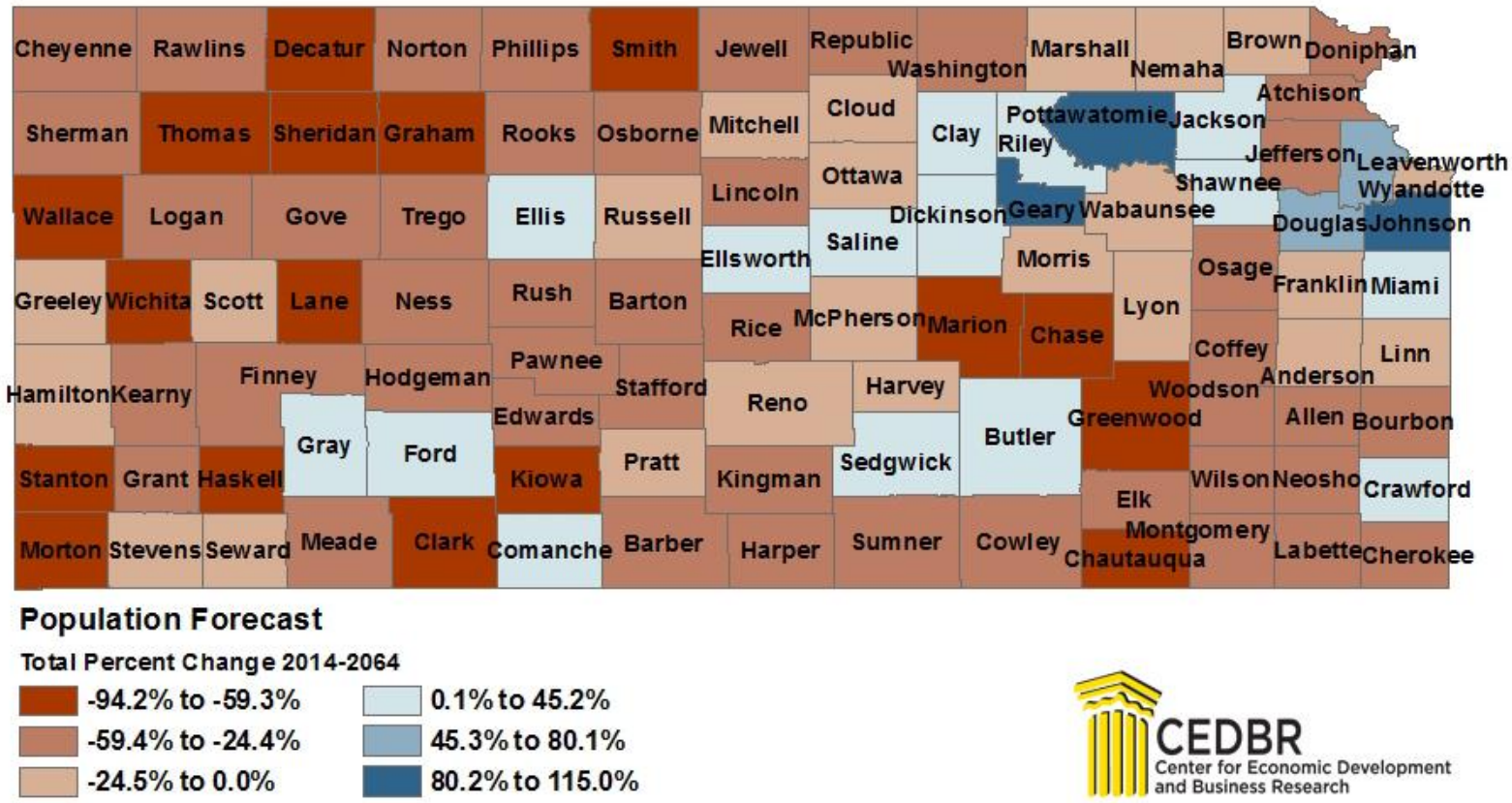
Tornadoes

- Unpredictable Future
  - Less data on tornadoes
  - Less understood physics
    - Warmer, moist climate would lead to more instability but also less wind sheer
  - Models aren't local enough
  - Could shift the timing of the regions most likely to be hit.

A Note on Model Predictions



Population Change as a Stressor



http://www.cedbr.org/population-projections-2

Other Types of Stressors

- Uncertain political and economic future
- Underfunded infrastructure maintenance
- Understaffed of lack of workforce

- What else?

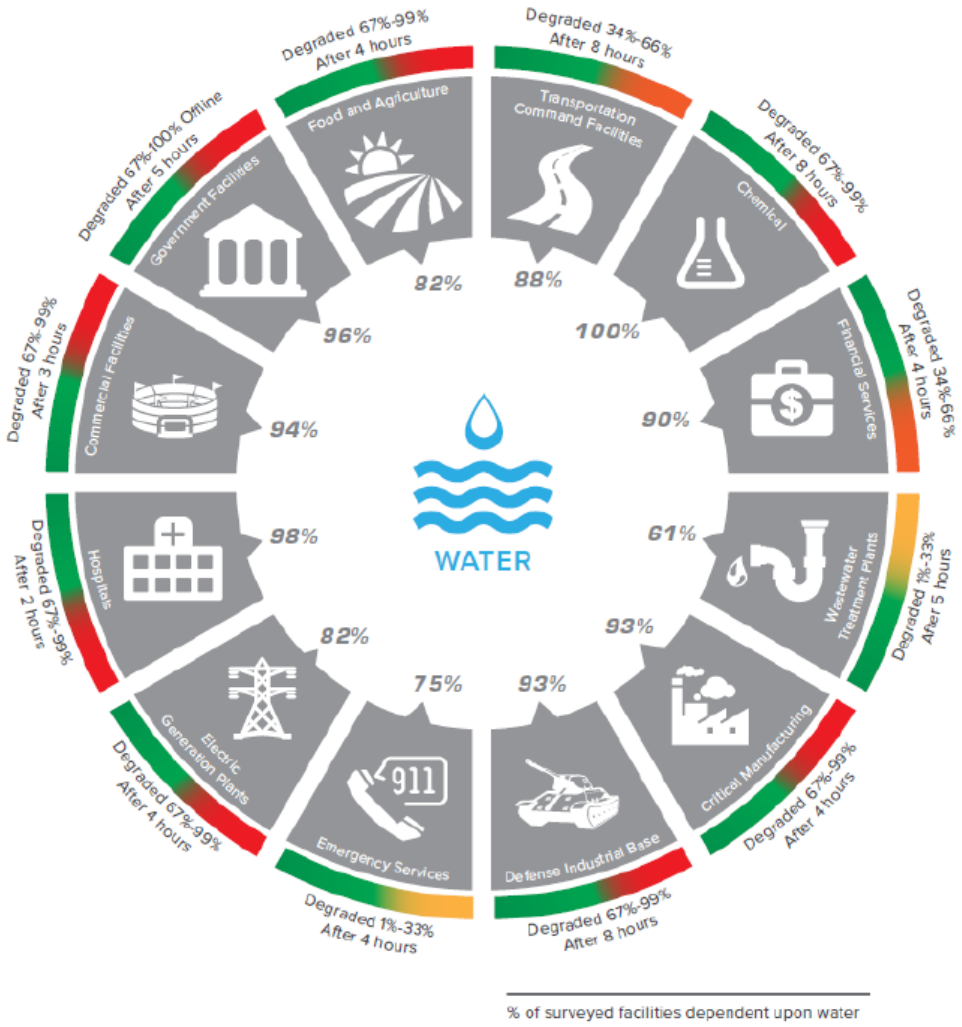
Kansas, What We Know

- Temperatures are rising
  - Warmer winters
  - Shorter winters
  - More summer days
  - Earlier summers
- Precipitation patterns are changing
  - More extreme events
    - Drought and Flooding

Assess Vulnerabilities

STEP TWO

Impacts to Critical Infrastructure with Loss of Water systems

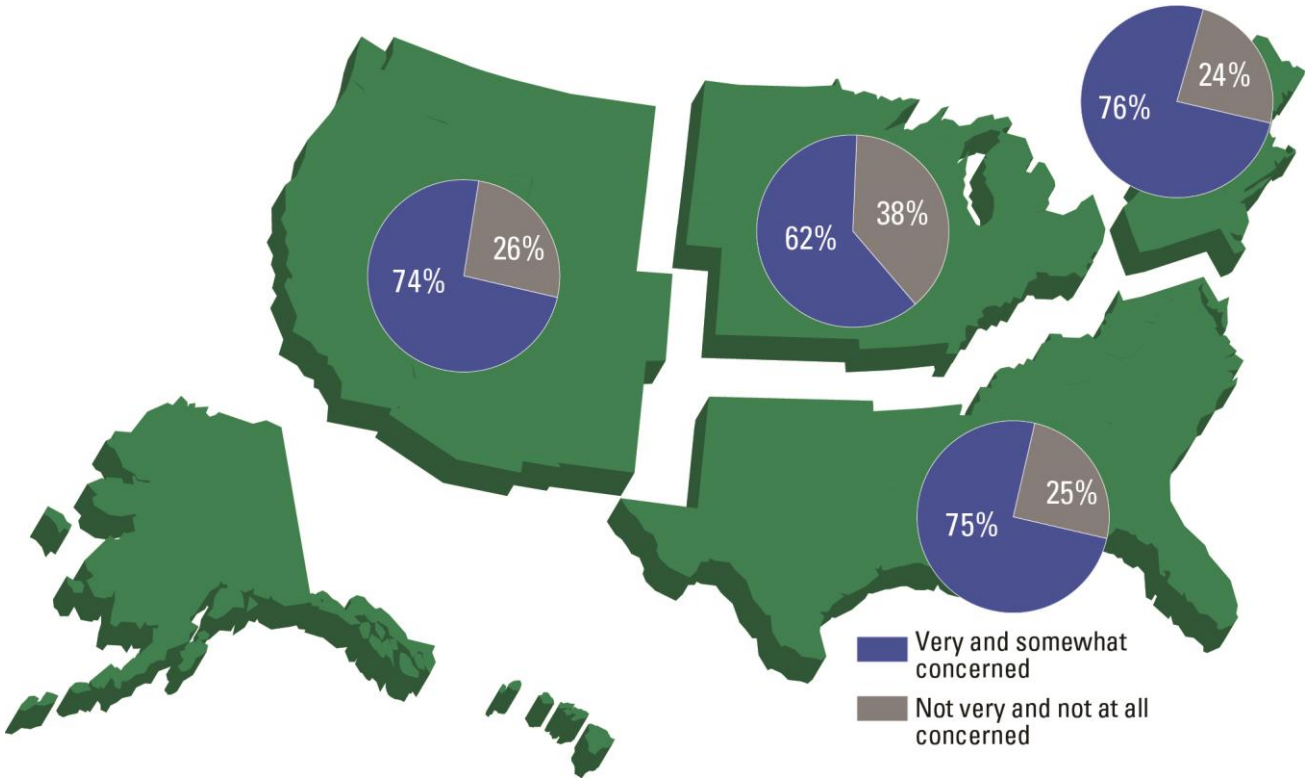


Note: This data represents a majority (60 percent or greater) dependence on water.

FIGURE 3.—Critical Infrastructure Dependent on Water and Potential Functional Degradation Following a Loss of Water Services (Courtesy of DHS and Argonne National Laboratory).

http://www.inh2o.org/wp-content/uploads/OCIA-Water-and-Wastewater-Treatment-Systems-Sector-Resilience-Report.pdf

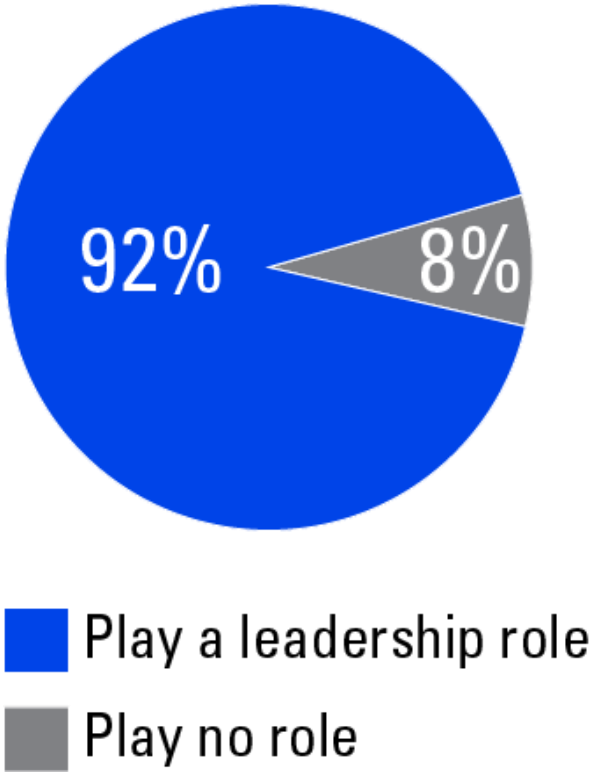
How concerned are you that future extreme weather events will negatively impact your community water provider's ability to provide safe, healthy drinking water?



Effective Communication about Climate Change to Water Utility Stakeholders. Water Research Foundation 2014.

How large of a leadership role should your community water utility play in helping your community prepare for the impacts of climate change?

92% of Americans want their water utility to be a leader in preparing the community for the impacts of climate change



Effective Communication about Climate Change to Water Utility Stakeholders. Water Research Foundation 2014.

Example of Impacts on Critical Infrastructure

Threats		
Climate Change	Population Change	Political/Economic Change

↓

System Failure			
Change in demand	Contamination	Pump Failure	Power System Failure

↓

Service Impact		
Water Supply Interruption	Drain blockage	Pollution

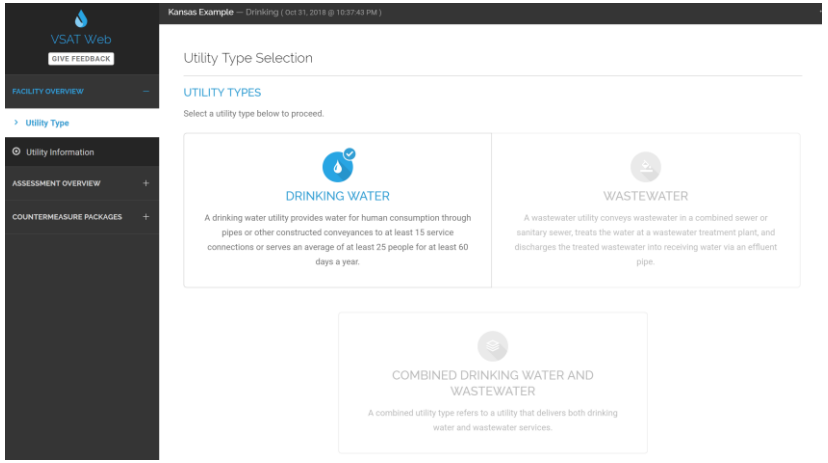
↓

Consequences			
Property Damage	Loss of Earnings	Injury	Disease

(Butler, D., Ward, S. et. al., March 2016)

Vulnerability Self-Assessment Tool

- VSAT web-tool
  - Identify the highest risks to mission-critical operations
  - Finds most cost-effective measures to reduce those risks



https://vsat.epa.gov/vsat/

Risk = Threat x Vulnerability x Consequence

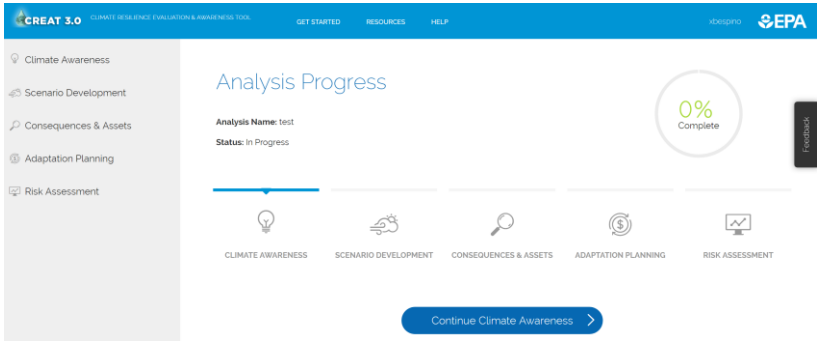
- Threat = any event that could impair utility
  - Natural disasters, cyber-attacks, vandalism, power outage, etc.
- Vulnerability = likelihood of damage if a specific threat occurs
- Consequences = adverse impacts that result when a threat causes damage to a utility asset
  - Economic costs, equipment damage, injuries, fatalities, etc.
- Countermeasures= systems or practices that reduce the risk from threat to utility assets
  - Security measures, resilient equipment, emergency response plans

If a 100-year flood occurred, what is the likelihood that it would impair your utility's treatment or distribution operations?

https://vsat.epa.gov/vsat/

Climate Resilience Evaluation and Awareness Tool (CREAT)

- Risk assessment tool
- Helps utilities in adapting to extreme weather events through a better understanding of current and future climate conditions.



https://www.epa.gov/crwu/build-resilience-your-utility https://youtu.be/fa0oK_jE8Zw

Developing Plans

STEP THREE

Water Conservation Plan

2007 Kansas Municipal Water Conservation Plan Guidelines

Kansas Water Office
901 S. Kansas Avenue
Topeka, KS 66612-1249
785-296-3185
www.kwo.org

An Equal Opportunity Employer

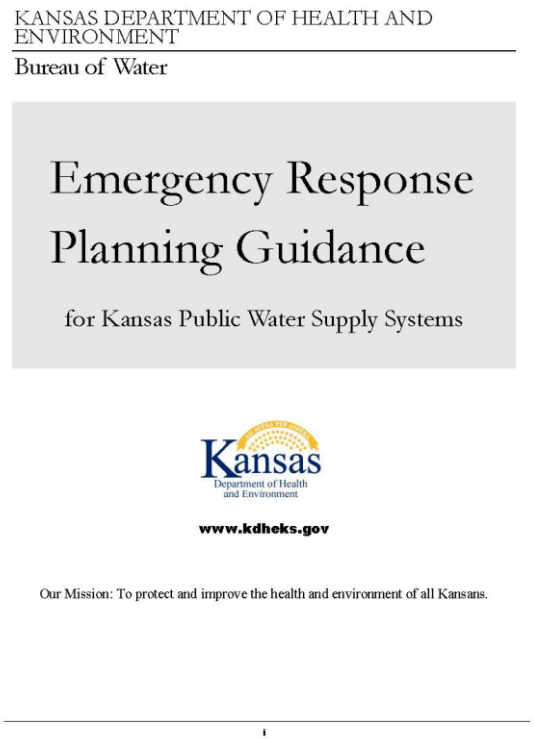
August 2007

TABLE 2

Long-Term Water Use Efficiency Component	Water Use Efficiency Practices	Plan Guideline Status					
		Small Water Utilities[a/]		Medium Water Utilities[b/]		Large Water Utilities[c/]	
		Low or Medium GPCD[d/]	High GPCD[e/]	Low or Medium GPCD[d/]	High GPCD[e/]	Low or Medium GPCD[d/]	High GPCD[e/]
B. Management	1. All source water will have meters installed and the meters will be repaired or replaced within two weeks when malfunctions occur.	Highly Recommended	Highly Recommended	Highly Recommended	Highly Recommended	Highly Recommended	Highly Recommended
	2. Meters for source water will be tested for accuracy at least once every three years. Each meter will be repaired or replaced if its test measurements are not within industry standards (such as AWWA standards).	Highly Recommended	Highly Recommended	Highly Recommended	Highly Recommended	Highly Recommended	Highly Recommended
	3. Meters will be installed at all residential service connections and at all other service connections whose annual water use may exceed 300,000 gallons, including separate meters for municipally operated irrigation systems which irrigate more than one acre of turf.	Recommended	Highly Recommended	Recommended	Highly Recommended	Recommended	Highly Recommended
	4. Meters at each individual service connection will be replaced or tested for accuracy on a regular basis, per industry standards (such as AWWA standards), if they are one inch or less. Meters between one inch and six inches will be tested for accuracy at least once every five years and meters six inches and above will be tested on at least an annual basis. Each meter will be repaired or replaced if its test measurements are not within industry standards (such as AWWA standards).	Optional	Recommended	Optional	Highly Recommended	Recommended	Highly Recommended
	5. All meters for source water will be read at least on a monthly basis and meters at individual service connections will be read at least once every two months.	Highly Recommended	Highly Recommended	Highly Recommended	Highly Recommended	Highly Recommended	Highly Recommended

TABLE 2			
Long-Term Water Use Efficiency Component	Water Use Efficiency Practices	Small Water Utilities[a/]	
		Low or Medium GPCD[d/]	High GPCD[e/]
B. Management	1. All source water will have meters installed and the meters will be repaired or replaced within two weeks when malfunctions occur.	Highly Recommended	Highly Recommended
	2. Meters for source water will be tested for accuracy at least once every three years. Each meter will be repaired or replaced if its test measurements are not within industry standards (such as AWWA standards).	Highly Recommended	Highly Recommended

Emergency Response Plan Guidance


KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT

Bureau of Water

Emergency Response Planning Guidance

for Kansas Public Water Supply Systems

Kansas Department of Health and Environment

www.kdheks.gov

Our Mission: To protect and improve the health and environment of all Kansans.

- Vulnerability Assessment
- Assets
- Physical Protection System
- Emergency Water Requirements
- Communications
- Personnel Safety

http://www.kdheks.gov/water/download/Emergency_Response_Planning_Guidance_01_11_2005.pdf

Stages of Service Recovery

First
- Survival condition
- Potable water in extremely minimum quantities

Second
- Attained within two days
- Potable water for general sanitation

Third
- Near normal levels for drinking, cooking, and sanitation
- Fire protection

Fourth
- Nearly normal service
- Partial service to industrial, commercial, and agriculture

Example Strategy

*Structural Damage/Physical Attack to Water System or Facility(ies)**

Threat Warning Stage

Threat Warning Received	Special actions and notifications to be taken: • Notify ER Lead or Alternate ER Lead • Record and document all information pertaining to the threat warning • Do not disturb site if the threat warning could be a possible crime scene • Return to normal operations if no further action is required (i.e., the threat warning can be explained) • Begin the "Threat Decision Process" if the threat warning cannot be explained

↓

Threat Decision Process Stage

Is the Threat Possible? (Stage 1)	Special actions and notifications to be taken: • Notify local law enforcement • Notify State Drinking Water Primacy Agency • Evaluate threat warning and make decisions in consultation with State Drinking Water Primacy Agency and local law enforcement • Initiate basic precautionary measures: 1. Alert staff and personnel about threat warning 2. Heighten security at critical facilities 3. Prepare additional notification lists if the situation escalates to the "Is the Threat Credible?" stage

↓

If the threat is not possible, then return to normal operations. Otherwise, proceed to "Is the Threat Credible" stage.

Is the Threat Credible? (Stage 2)	Special actions and notifications to be taken: • Activate notification and personnel safety portions of ERP • Physically secure water system facilities • Evaluate whether the threat is credible in consultation with assisting agencies

↓

If the threat is not credible, then return to normal operations. Otherwise, proceed to "Has the Threat been Confirmed" stage.

Has the Incident Been Confirmed? (Stage 3)	Special actions and notifications to be taken: • Initiate full ERP activation • Follow State Incident Command System • Deploy damage assessment team • Isolate damaged facility from rest of water system • Coordinate alternative water supply, as needed, or consider alternate (interim) treatment schemes • Issue public notice and issue follow-up media press releases • Repair damaged facilities • Assess need for additional protection/security measures

Prepare, Plan, and Recover from A Tornado – Check List

EPA

Incident Action Checklist – Tornado

The actions in this checklist are divided up into three "rip & run" sections and are examples of activities that water and wastewater utilities can take to: prepare for, respond to and recover from a tornado. For on-the-go convenience, you can also populate the "My Contacts" section with critical information that your utility may need during an incident.

Tornado Impacts on Water and Wastewater Utilities

Tornadoes can occur in any location with little to no notice. Tornadoes can have wind gusts from 65 to over 200 miles per hour (mph) and are often accompanied by floods, high straight-line winds up to 140 mph, hail and lightning. About 1,200 tornadoes occur in the United States each year, and they can have devastating impacts to water and wastewater utilities. Impacts may include, but are not limited to:

- Damage to infrastructure (e.g., storage tanks, hydrants, residential plumbing fixtures, distribution system) due to hail, wind, debris and flash flooding, resulting in loss of service and/or reduced pressure throughout the system
- Restricted access to the facility due to debris and damaged roads
- Loss of power and communication lines
- Potential contamination due to chemical leaks from ruptured containers
- Severe water and pressure loss due to ruptured service lines in damaged buildings and broken fire hydrants from airborne debris

NOAA

The following sections outline actions water and wastewater utilities can take to prepare for, respond to and recover from a tornado.

Example of Water Sector Impacts and Response to a Tornado

Smithville, Mississippi 2011 Tornado

An EF-5 tornado with estimated winds of 205 mph and a half-mile wide base hit Smithville, Mississippi in April 2011, destroying 150 homes and several businesses and city facilities, including the water system. The utility's elevated storage tank was damaged and several pipes were bent due to a car striking the structure. The tornado also tore out appliances and plumbing fixtures from homes and destroyed at least three fire hydrants.

Both the drinking water and wastewater systems lost power immediately after the tornado hit, and half of the town was without water due to damage to infrastructure and the power outage. Generators were coordinated through the Mississippi Rural Water Association to provide temporary power. The drinking water and wastewater utilities conducted damage assessments and teams were quickly deployed to fix leaks, turn off meters in destroyed homes and restore service throughout the systems.

Source: NRWA's "Rural Water assists tornado-ravaged Mississippi"

1 of 8

- Planning
- Coordination
- Customer Communication
- Facility and Service Area
- Personnel
- Power Energy and Fuel
- Contacts
- Resources

Drought Recovery and Response

- Staffing, Response Plans, Funding Considerations
- Water Supply and Demand Management
- Communication and Partnerships
- Case Studies and Videos

Staffing, Response Plans and Funding

Water Supply and Demand Management

Communication and Partnerships

Case Studies and Videos

IMPROVE SYSTEM EFFICIENCY

Implement measures to conserve water within your treatment and distribution system without affecting drinking water quality or other operational or regulatory requirements. During a drought, it is important to make improvements to your system first to set the example for your customers. Measures could include:

- Reducing pressure throughout all or part of the distribution system, while maintaining necessary pressure for "high priority" users such as hospitals and firefighters.
- Limiting main flushing as much as possible, while still meeting all regulatory requirements.
- Exploring beneficial uses for flushed water, such as irrigation, construction, fire-fighting storage or other non-drinking water uses.
- Recirculating backwash water to the head of your treatment plant.
- Aggressively finding and repairing leaks; consider including the following considerations and actions in your leak detection and repair program:
  - Authorizing overtime for construction crews.
  - Messaging, such as "Find It and Fix It," to immediately repair a leak on the customer side of the meter.
  - Encouraging self-policing by residents to alert the utility of system leaks.
  - Adopting an ordinance that requires customers to repair leaks within 7 days of being notified.
  - Providing a telephone hotline or website for customers to report leaks, with resources tied to field crew work orders to prioritize leak repairs over other maintenance activities.
  - Installing automated meter reading systems that can provide real-time water leak information.
  - Establishing a leak and minor plumbing repair program for low-income households.

BEST PRACTICE: Look for ways to manage your existing supplies through demand management, or modify system operations to increase supplies.

Involve your operators who understand how the system really works; leverage their ideas to reduce initial project costs and long-term operating costs.

- **Cities of Hays and Russell, Kansas.** Enhanced water treatment allows these utilities to blend lower quality groundwater with higher quality water sources, which enables them to use existing wells that would otherwise be abandoned. Both cities also routinely acidize their wells to maximize production rates.
- **City of Hogansville, Georgia.** The city has maintained many of the demand management practices initiated during its 2007 drought, such as reducing the frequency of main flushing and increasing information provided to customers to raise awareness of leaks and water use. Hogansville also installed all new meters citywide with software that provides "real time" water use data that helps them locate system leaks quickly.

After the Drought:

- Continue to implement your leak detection and repair program that ensures a prompt response mechanism for utility staff to make repairs. Prioritize and repair or replace components in the water distribution network that could lead to leaks.
- Look for other ways to use water efficiently throughout your utility or other departments, such as installing low-flow fixtures, retrofitting landscapes and replacing inefficient irrigation systems.
- Initiate a program to conduct annual water loss audits.

CASE STUDY: City of Hays and City of Russell, Kansas

Click on the video icon to go to the Drought Response and Recovery Project for Water Utilities: Case Studies Map to watch a video about the utilities' drought response.

SYSTEM DETAILS

- Located about 30 miles apart in central Kansas, the city of Hays and city of Russell share a groundwater source — the Smoky Hill River alluvium — and have worked together to respond to drought.

City of Hays	City of Russell
Population: 21,000 8,000 connections	Population: 4,500 2,400 connections
Large water users: battery factory, valve manufacturing plant, regional hospital (HaysMed)	Large water users: ethanol and gluten plant
Groundwater source from 31 wells: • Smoky Hill wellfield, upstream of Russell's Pfieffer wellfield in Smoky Hill River alluvium. • Big Creek Aquifer wellfield. • Dakota wellfield (produces brackish water, used as a back-up supply).	Groundwater and surface water sources: • Pfeifer wellfield (25 miles away in Smoky Hill River alluvium). • Surface water from Big Creek (has seasonal low-flows). • Stored water and water release rights from Cedar Bluff Reservoir, a U.S. Bureau of Reclamation reservoir upstream of the Smoky Hill wellfield.

IMPACT

The region has experienced drought periodically since the 1950s and twice during the past decade. The 2005 – 2006 drought was relatively brief but severe, requiring water use reductions in both communities. The 2011 – 2013 drought was longer and had a greater impact on the water supply of the city of Hays and city of Russell.

RESPONSE MEASURES

Staffing, Response Plans and Funding

Both cities have adopted drought response plans, and have internal drought teams that are led by the city manager and utility department staff under the direction of the City Council. The city of Russell's Municipal Water Conservation Plan clearly defines drought triggers and response actions for four drought stages. During 8 of the last 12 years, the city of Russell declared Stage 3 (Critical Water Stage) or Stage 4 (Water Emergency). The city of Hays has a three-stage drought response plan with established triggers, goals and response actions.

The cities have used a variety of funding sources to implement drought response actions and conservation. Both fund some drought response activities with their water rate revenue. Hays also implemented a 0.05 percent Water Conservation Sales Tax in 1995, and has used the State Revolving Fund to replace about 85 percent of its distribution system to reduce water loss. In the past 20 years, the city of Russell has replaced 80 percent of its water distribution lines, paid for with State Revolving Fund loans.

Water Supply and Demand Management

Both communities have in place year-round water conservation measures. During the 2005 – 2006 drought, the large industry users in Russell were asked to reduce water use to stretch limited supplies. They implemented ongoing measures, resulting in a 63 percent reduction over a 10-year period. Russell also has a water conservation education specialist who gives classes to local elementary school students, who then take

EPA 600/R-11/054 | June 2011 | www.epa.gov/research

EPA
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Planning for an Emergency Drinking Water Supply

Office of Research and Development
National Homeland Security Research Center

Additional Resources for Planning

Adaptation Strategies Guide for Water Utilities

GROUP		DW	WW
Drought	Reduced groundwater recharge	1	
	Lower lake & reservoir levels	1	
	Changes in seasonal runoff & loss of snowpack	2	
Water Quality Degradation	Low flow conditions & altered water quality		2
	Saltwater intrusion into aquifers	1	
	Altered surface water quality	1	1
Floods	High flow events & flooding	2	2
	Flooding from coastal storm surges	2	2
Ecosystem Changes	Loss of coastal landforms / wetlands	2	2
	Increased fire risk & altered vegetation	1	1
Service Demand & Use	Volume & temperature challenges	2	2
	Changes in agricultural water demand	1	
	Changes in energy sector needs	1	
	Changes in energy needs of utilities	2	2

EPA United States Environmental Protection Agency

CLIMATE READY WATER UTILITIES

EPA

HIGH FLOW EVENTS AND FLOODING (DW)

Return to Introduction

Intense precipitation events may occur more frequently, concentrating the annual total rainfall into episodes that may challenge current infrastructure for water management and flood control. When these protections fail, inundation may disrupt service and damage infrastructure such as treatment plants, intake facilities and water conveyance and distribution systems. Episodic peak flows into reservoirs will strain the capacity of these systems. Furthermore, inflow will be of lesser quality due to soil erosion and contaminants from overland flows, leading to treatment challenges and degraded conditions in reservoirs.

CLIMATE INFORMATION

- Since 1991, the amount of rain falling in very heavy precipitation events has been above average across most of the United States (USGCRP 2014). This observed trend has been greatest in the Northeast, Midwest and Great Plains – projections for these regions indicate that 30% more precipitation will fall in very heavy rain events relative to the 1901-1960 average (Karl et al. 2009).
- Heavy downpours are increasing nationally, with especially large increases in the Midwest and Northeast (Kunkel et al. 2012, USGCRP 2014). Precipitation intensity (e.g., precipitation per rainy day) is projected to continue to increase by mid-century for most of the U.S. This change is expected even for regions that are projected to experience decreases in mean annual precipitation, such as the Southwest (Kunkel et al. 2012, Wehner 2013, USGCRP 2014).
- The increasing intensity of precipitation events can be expected to lead to more flooding and high flow events in rivers. For example, by the end of the century, New York City is projected to experience almost twice as many days of extreme precipitation that cause flood damage (Ntelekos et al. 2010). For the U.S. overall, a recent assessment of flood risks found that the odds of experiencing a 100-year flood are expected to double by 2030 (USGCRP 2014).
- The intensity, frequency and duration of North Atlantic hurricanes has increased in recent decades, and the intensity of these storms is likely to increase in this century (USGCRP 2014).

ADAPTATION 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 11 in the Introduction.
Click on the or icon to review the relevant Sustainability Brief.

✓	PLANNING	COST
	Integrate flood management and modeling into land use planning.	$
	Develop models to understand potential water quality changes (e.g., increased turbidity) and costs of resultant changes in treatment.	$
	Expand current resources by developing regional water connections to allow for water trading in times of service disruption or shortage.	$$-$$$
	Plan for alternative power supplies to support operations in case of loss of power.	$
	Adopt insurance mechanisms and other financial instruments, such as catastrophe bonds, to protect against financial losses associated with infrastructure losses.	$
	Conduct training for personnel in climate change impacts and adaptation.	$
	Ensure that emergency response plans deal with flooding contingencies and include stakeholder engagement and communication.	$
	Establish mutual aid agreements with neighboring utilities.	$

Continued on page 2

https://www.epa.gov/sites/production/files/2015-04/documents/updated_adaptation_strategies_guide_for_water_utilities.pdf

Climate Change Workshop Planner

WORKSHOP PLANNER FOR

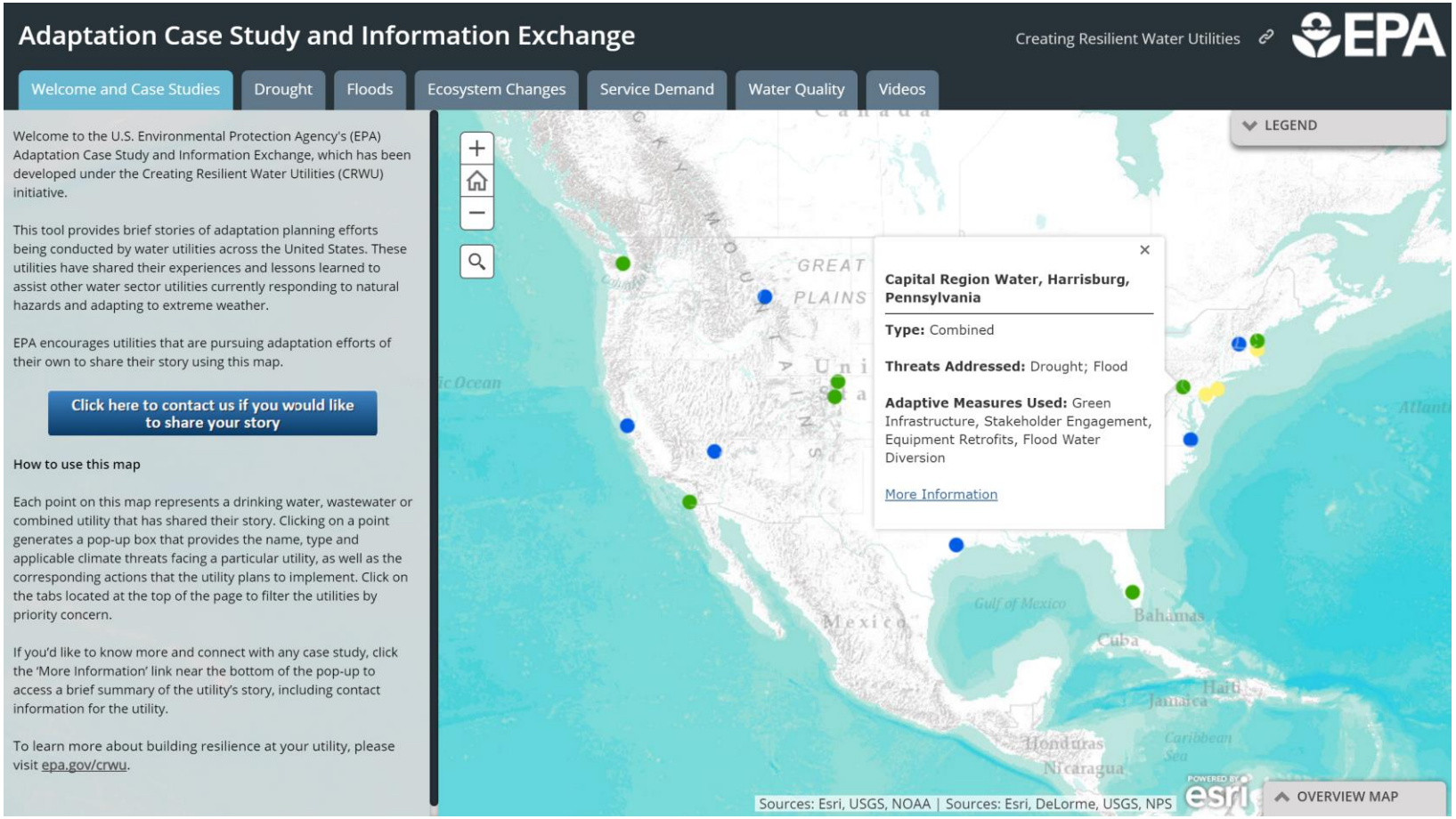
Climate Change and Extreme Events Adaptation

Understanding and adapting to climate change threats is an important part of decision making for water, wastewater and stormwater utilities. Extreme events including floods, drought, sea-level rise, wildfires and reduced snowpack may become more frequent or intense due to climate change. Planning for these extreme events can help protect utility infrastructure and operations, allowing utilities to provide reliable and sustainable service to their customers.

https://workshopplanner.epa.gov/eewp/

https://www.epa.gov/crwu/plan-climate-change-your-utility

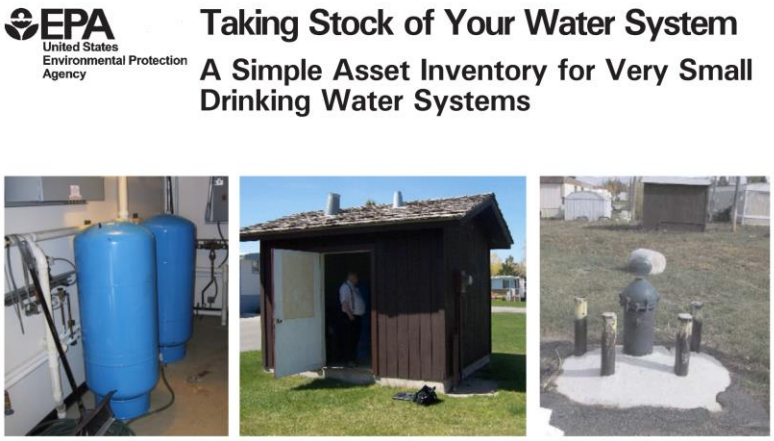
Adaptation Case Studies

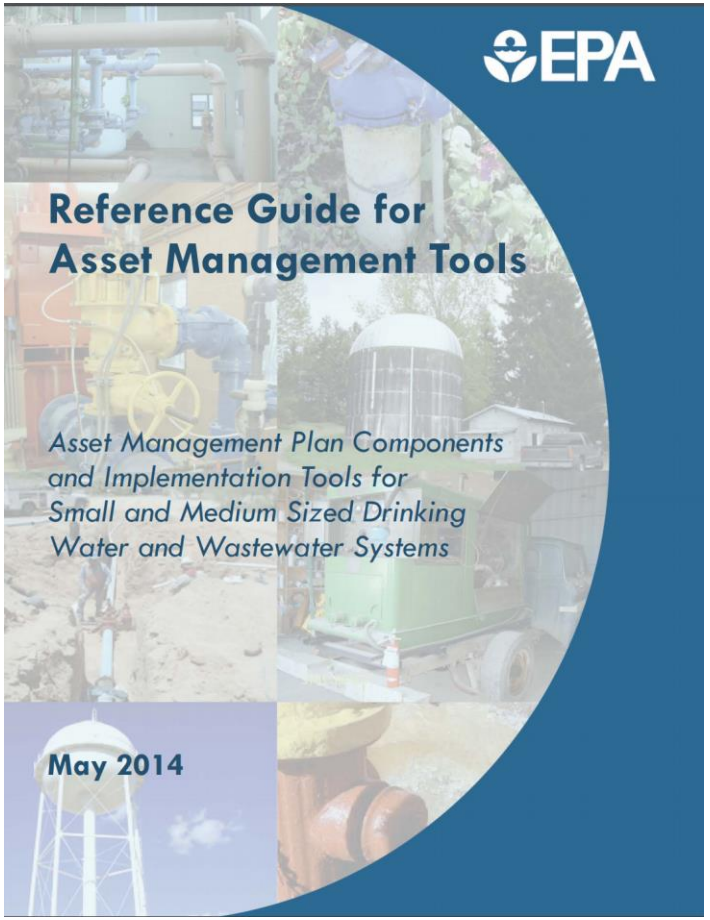


https://epa.maps.arcgis.com/apps/MapSeries/index.html?appid=bfe6b44929a8417b86aa7fd81d6857be

New Hampshire example- https://www.des.nh.gov/organization/divisions/water/dwgb/documents/wd-14-02.pdf

Asset Management Resources





https://www.epa.gov/sites/production/files/2015-04/documents/epa816k03002.pdf

https://www.epa.gov/sites/production/files/2016-04/documents/am_tools_guide_may_2014.pdf

Information Sharing to Support Resilience

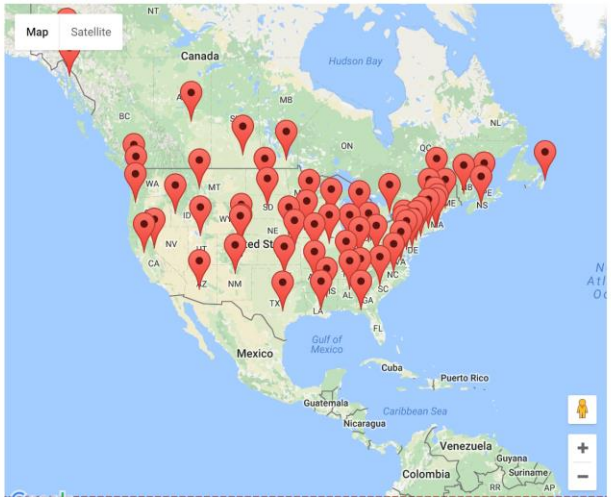
Water/Wastewater Agency Response Network (WARN)

WARN℠

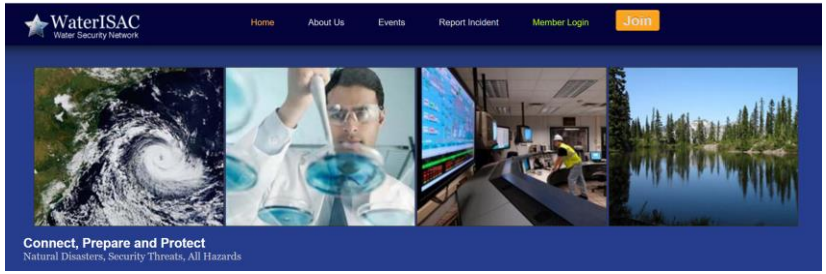
WATER /WASTEWATER AGENCY RESPONSE NETWORK

A Water and Wastewater Agency Response Network is a network of utilities helping other utilities to respond to and recover from emergencies. The purpose of a WARN is to provide a method whereby water/wastewater utilities that have sustained or anticipate damages from natural or human-caused incidents can provide and receive emergency aid and assistance in the form of personnel, equipment, materials and other associated services as necessary from other water/wastewater utilities.

Click a pin to view contact information for the local WARN representative, with a link to more information about that state and region. You can also view current **Situation Reports**.



Water Information Sharing and Analysis Center (WaterISAC)



https://www.awwa.org/resources-tools/water-knowledge/emergency-preparedness/water-wastewater-agency-response-network.aspx

https://www.waterisac.org/

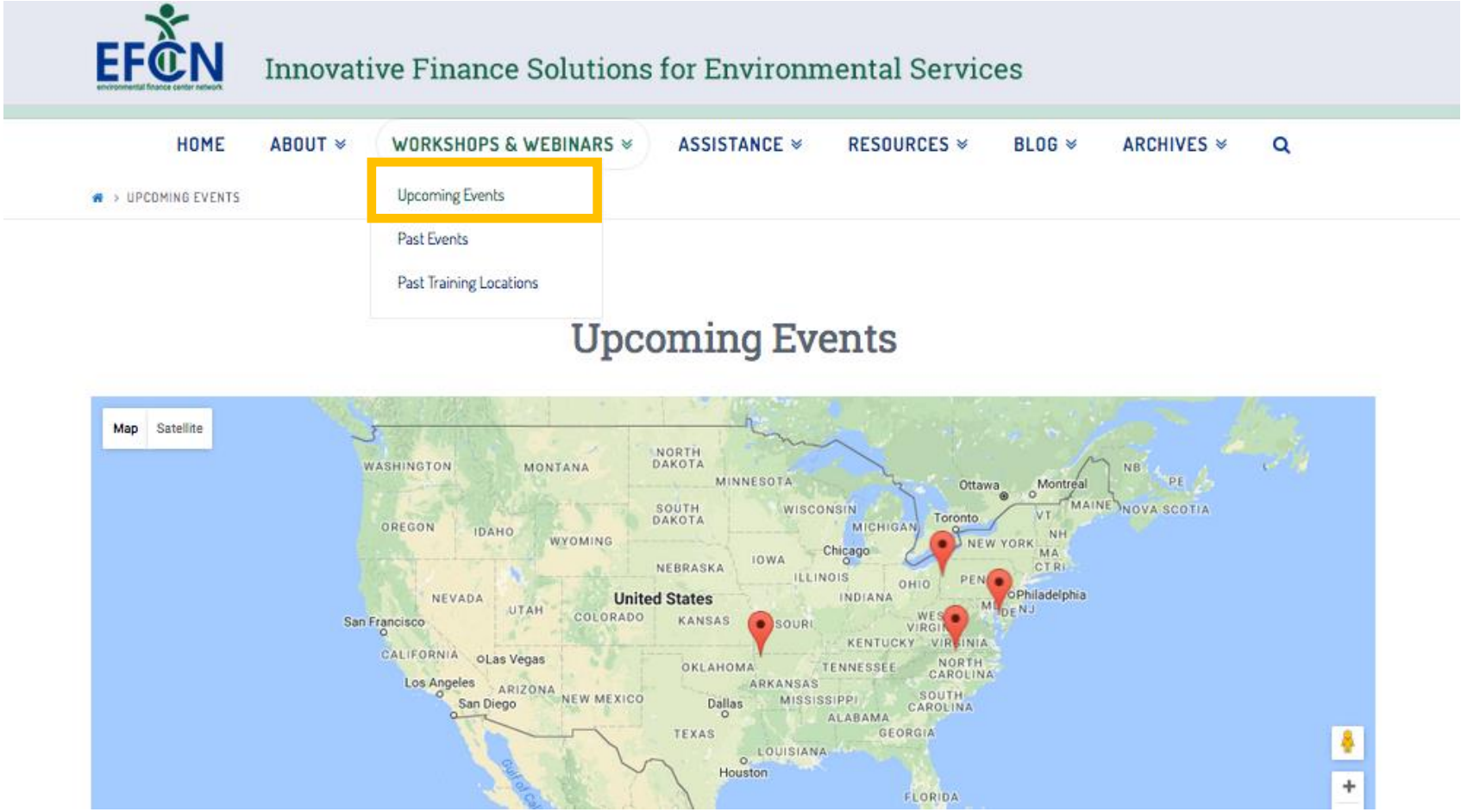
Interactive Exercise

Visit the EFCN Website – *www.efcnetwork.org*

for more information on upcoming events, funding, and resources.

Upcoming Events Calendar

Select “Upcoming Events” under the Workshops & Webinars Tab.

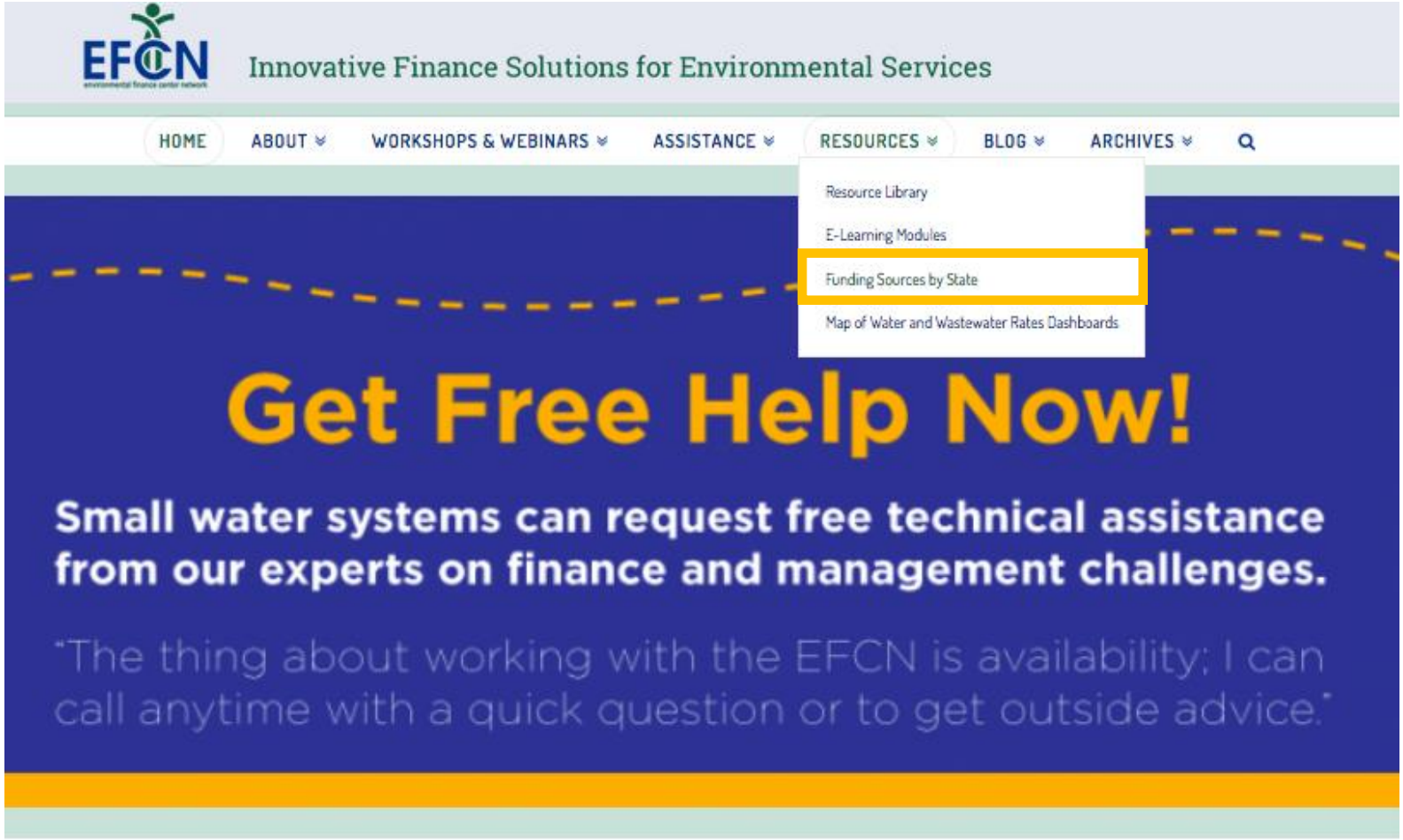


= In Person Event = Webinar

Type	Date/Time	Event
	03/09/2017 2:00 pm - 3:00 pm	WEBINAR I Preparing Winning Financing Applications for Water Infrastructure Projects
	03/22/2017 2:00 pm - 3:00 pm	WEBINAR I Water Audits and Water Loss Control: Entering Your Data into the Spreadsheet
	03/30/2017 9:00 am - 4:30 pm	Maryland I Rates and Finance Workshop for Small Water Systems *Easton Utilities, Easton MD*
	04/04/2017 1:00 pm - 2:00 pm	WEBINAR: Workforce Development: An Overview of Key Components
	05/11/2017 9:00 am - 4:30 pm	Virginia I Rates and Finance Workshop for Small Systems *The Institute for Advanced Learning and Research, Danville Virginia*
	05/25/2017 9:00 am - 4:30 pm	Arkansas I Rates and Finance Workshop for Small Water Systems *Beaver Water District, Lowell AR*
	09/13/2017 9:00 am - 4:30 pm	Pennsylvania I Rates and Finance Workshop for Small Water Systems *Pennsylvania American Water Co, New Castle PA*

Funding Tables By State

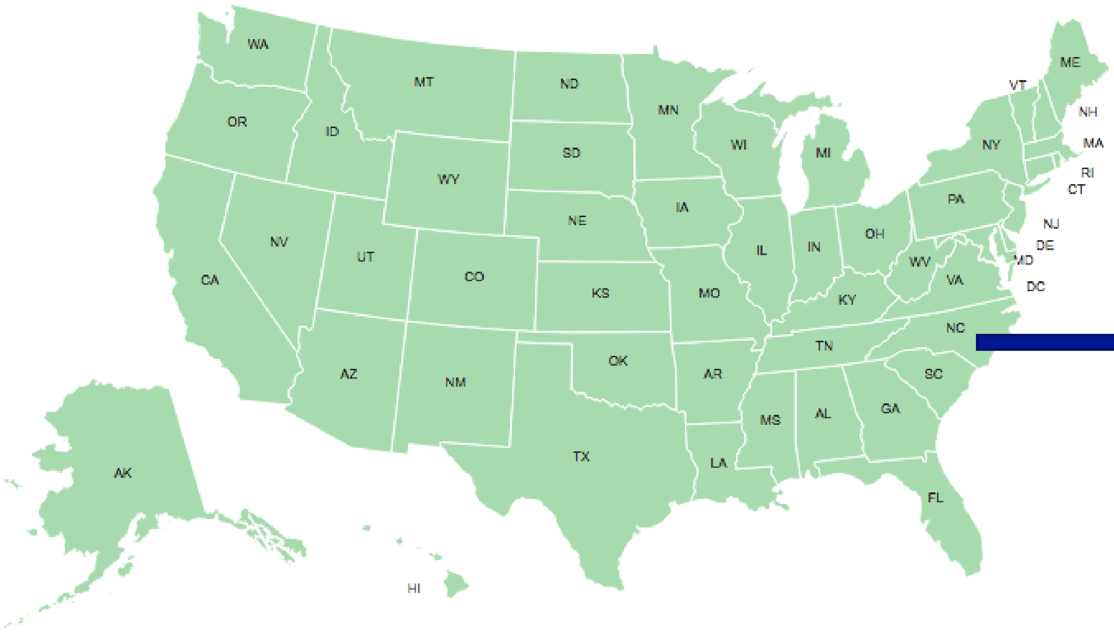
Select “Funding Sources by State” under the Resources Tab.



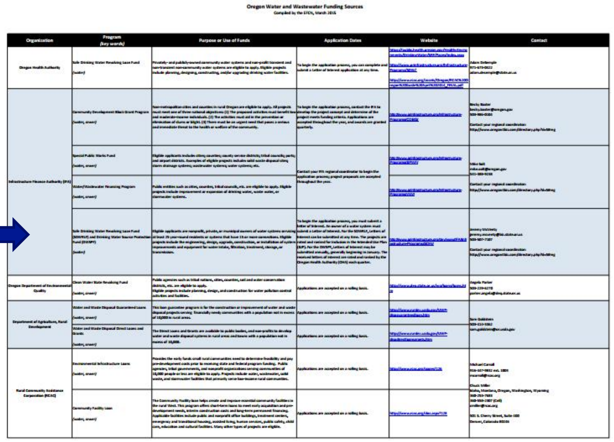
Funding Sources by State

Note: Some states may have additional resources listed below the map.

Click on the map below to view funding sources for each state:

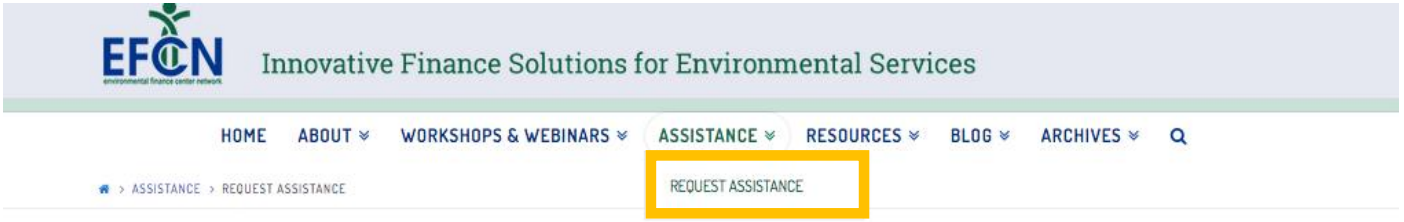


Click on an individual state to view funding table.



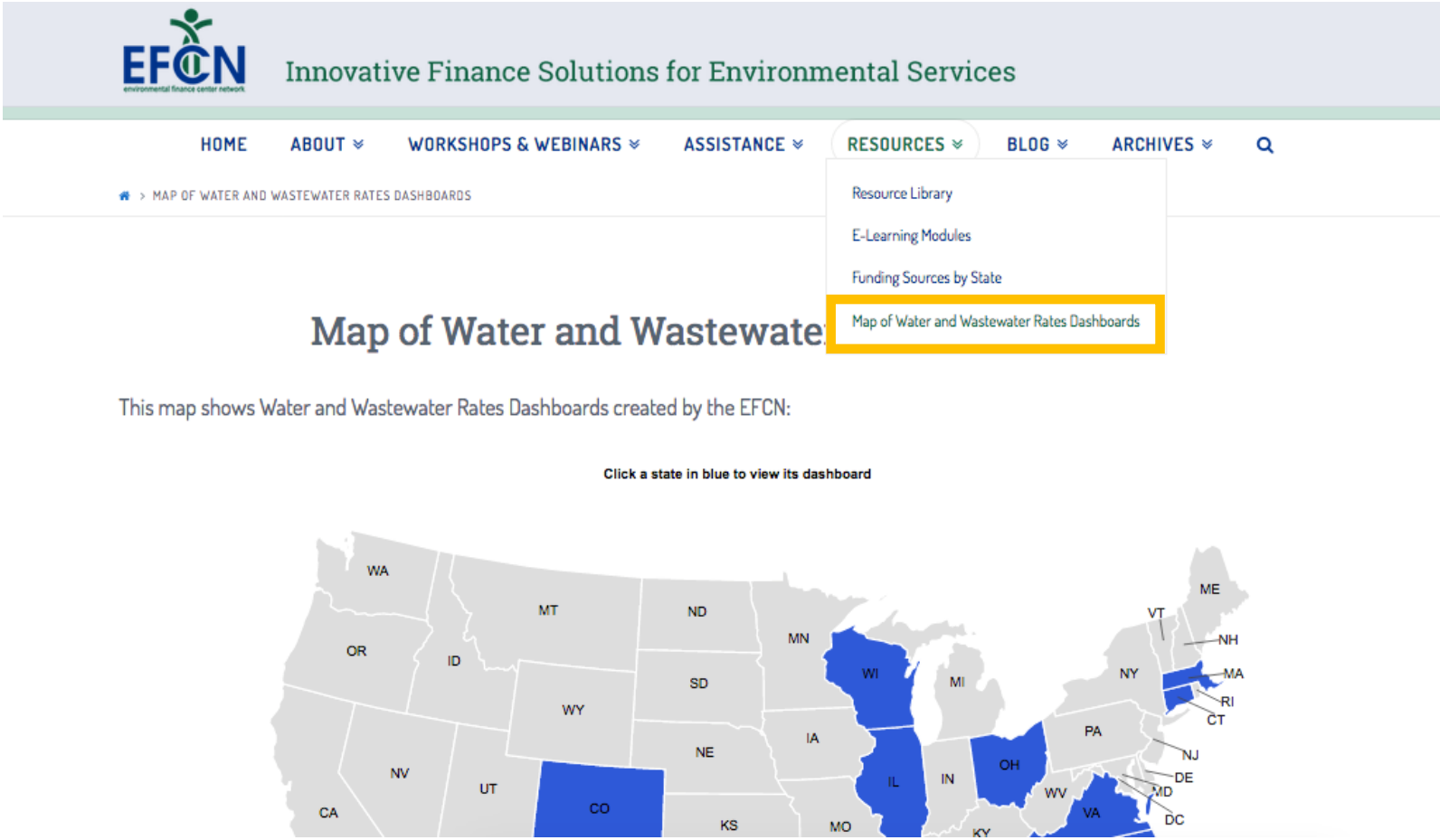
Request Technical Assistance

Select “Request Assistance” under the Assistance Tab off the EFCN homepage to access and submit the TA request form electronically.



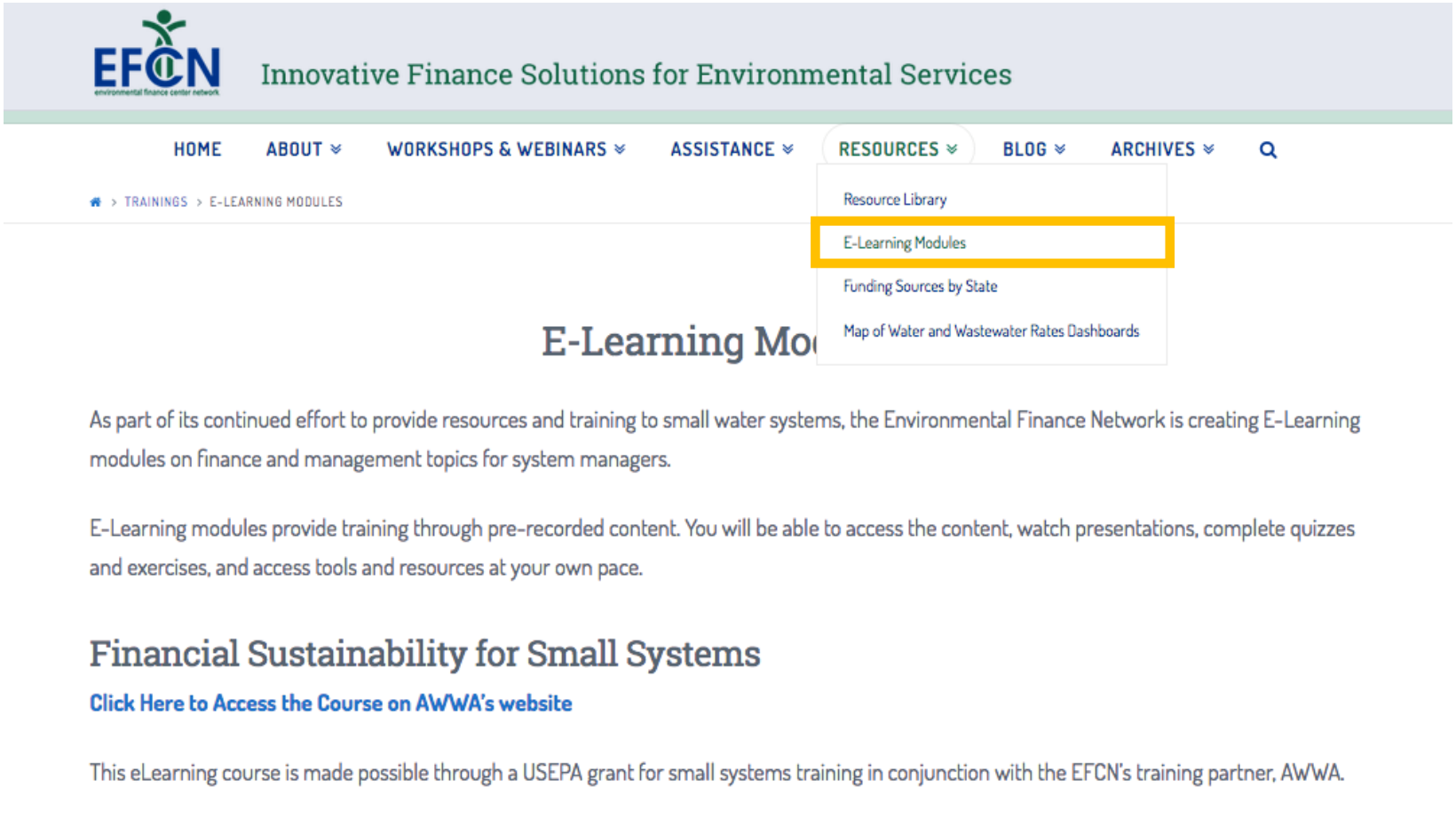
Rates Dashboards

Select “Map of Water and Wastewater Rates Dashboards” under the Resources Tab, and click on any state in blue to view its dashboard.



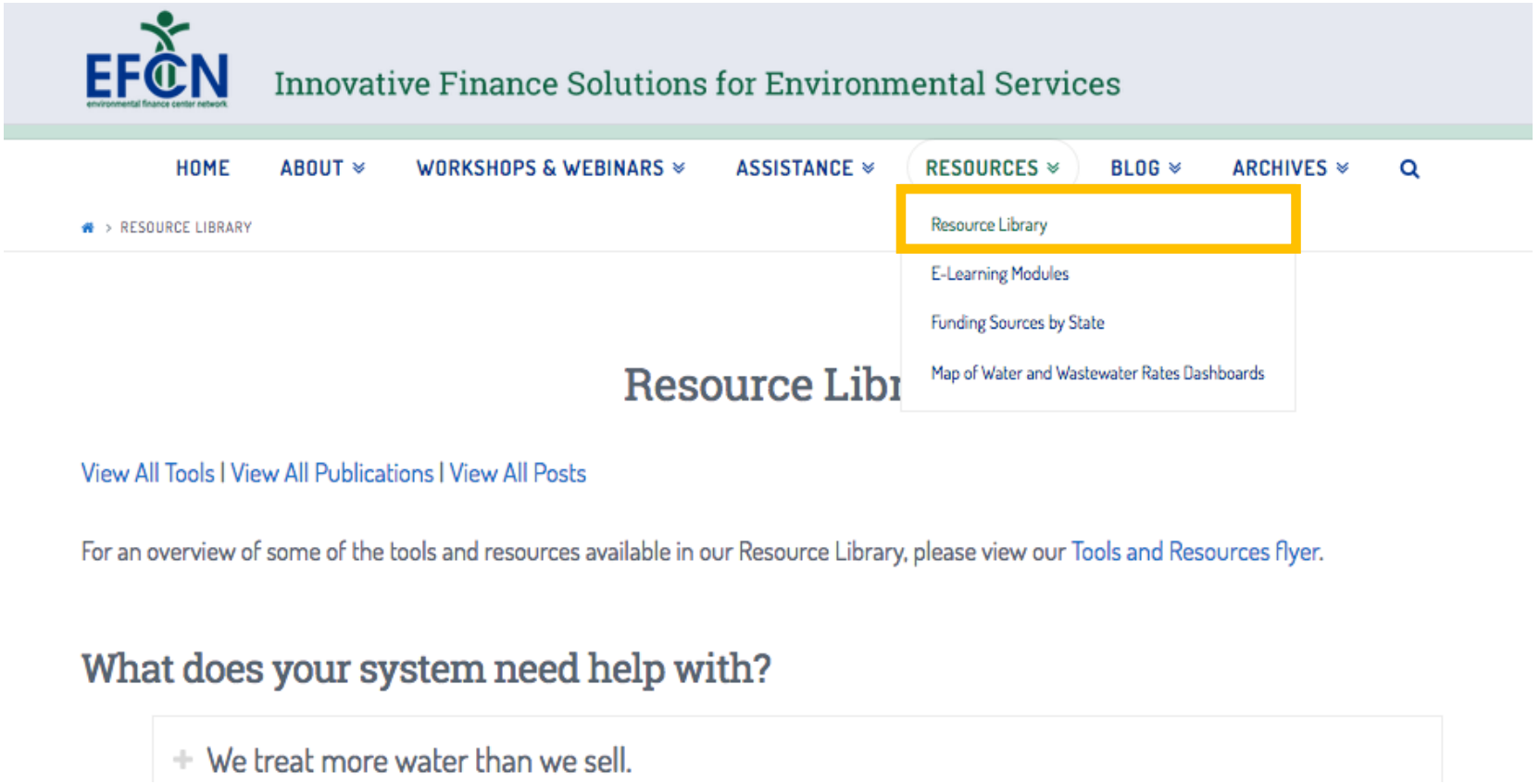
E-Learning Modules

Select “E-Learning Modules” under the Resources Tab off the EFCN homepage.



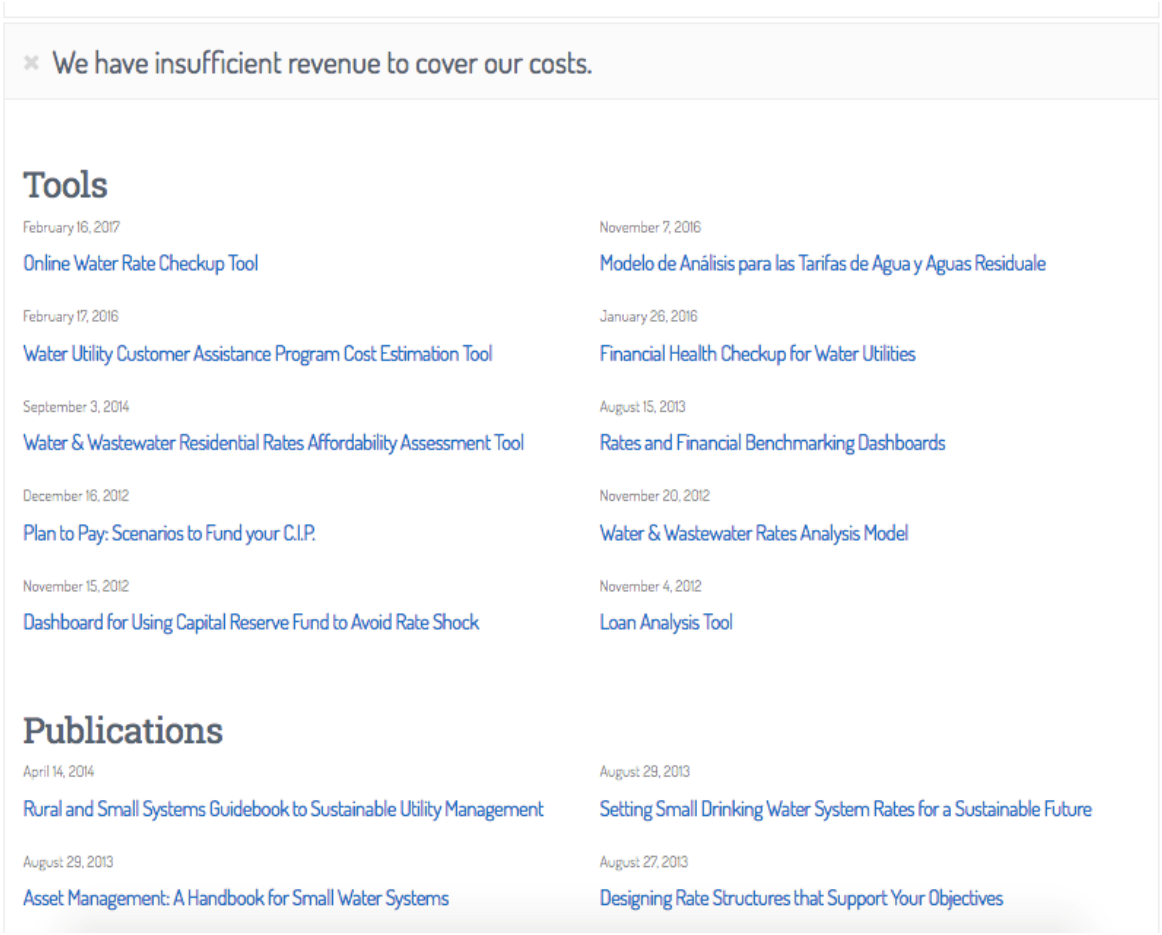
Resource Library

Select “Resource Library” under the Resources Tab off the EFCN homepage.



Resource Library Continued…

Click on a what your system needs help with to reveal tools and publications related to that topic.



This project has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement A18-0408-001 to the University of North Carolina at Chapel Hill. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document.

Smart Management for Small Water Systems

Thank you for participating today.
We hope to see you at a future workshop!

www.efcnetwork.org

EFCN environmental finance center network

NADO National Association of Development Organizations Research Foundation

Government Finance Officers Association