Smart Management for Small Water Systems

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

*www.efcnetwork.org*

New England Environmental Finance Center

EFCN environmental finance center network

NADO Research Foundation

Government Finance Officers Association

University of Maryland Environmental Finance Center

**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

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, National Association of Development Organizations, Research Foundation

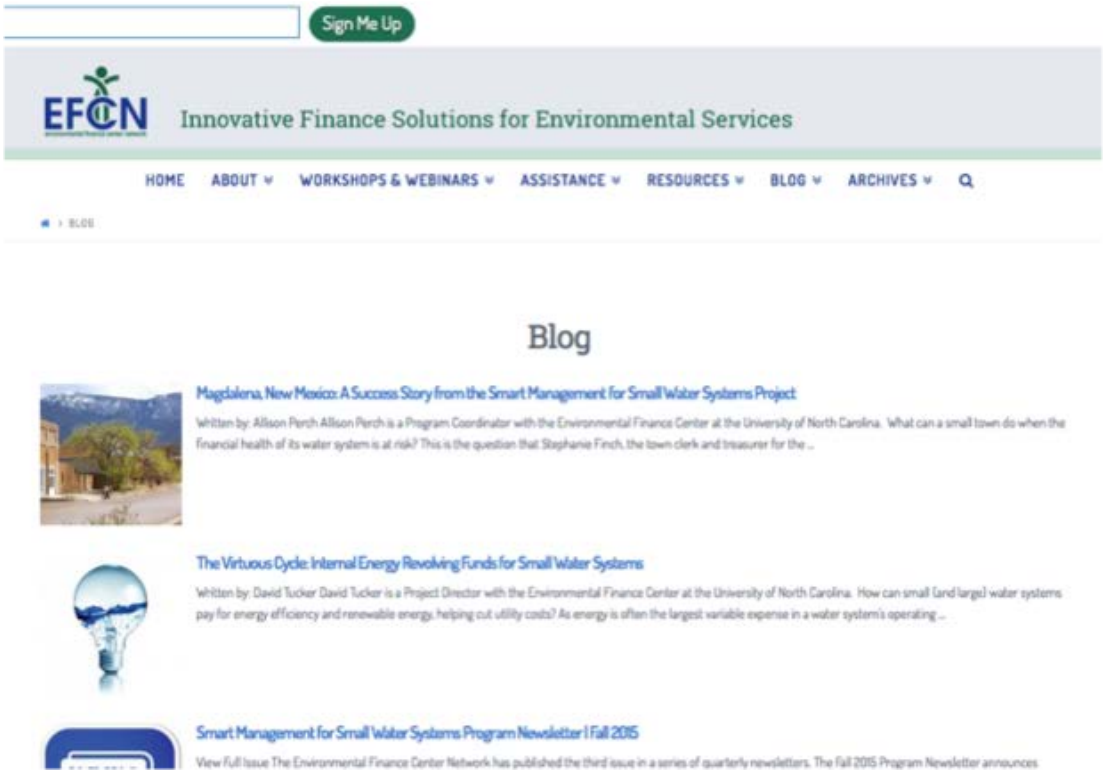
# Areas of Expertise

- 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

| | |
|---|---|
| 9:00 – 9:30AM | Introduction to Resiliency |
| 9:30 – 10:15AM | Trends in Risks: Threats and Opportunities for Water Systems |
| 10:15 – 10:25AM | BREAK |
| 10:25 – 11:15AM | Conducting Vulnerability Assessments and Planning Ahead |
| 11:15 – 12:00PM | Funding Opportunities in Rhode Island<br>• Rhode Island Infrastructure Bank \| Michael Baer<br>• Rhode Island USDA \| Joanne Demars |
| 12:00 – 1:00PM | LUNCH |
| 1:00 – 3:15PM | The Game of Floods – Tying it all together through an interactive simulation activity |
| 3:15 – 3:30PM | Wrap Up |


Who Are You?
And why are you here?

# Objectives

- What is resilience and why is it important.
- How to identify threats and their impacts and consequences to water systems.
- How to use available tools to conduct a vulnerability assessment and begin planning ahead.
- How to access local resources.

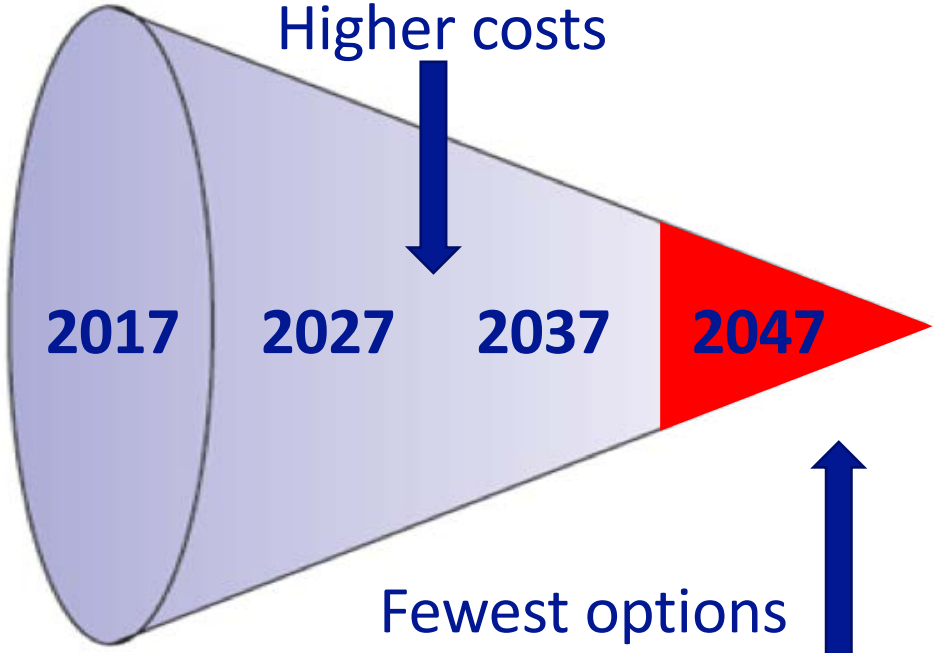
# Defining Resilience

Thriving in an Uncertain Future

# 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

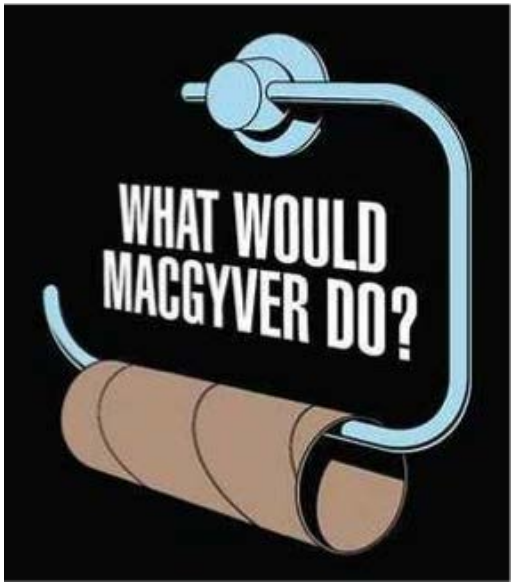
Flint Michigan - 2015

# 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

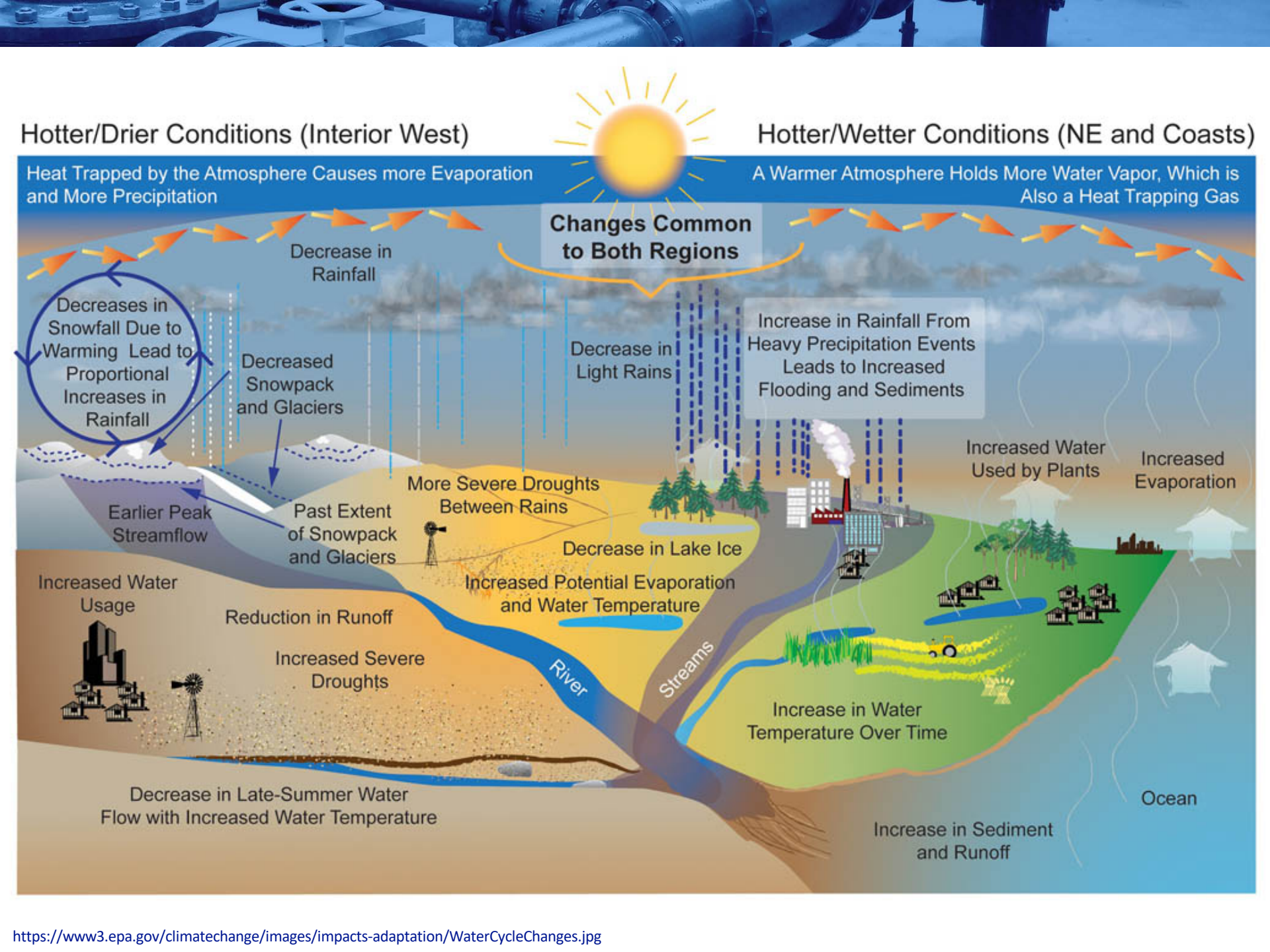




# Rhode Island Example- The Great Flood of 2010

# Identifying Threats


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

| Hazard | Stressor |
| --- | --- |
| Acute | Chronic |
| Short-term damage | Slowly weakens |



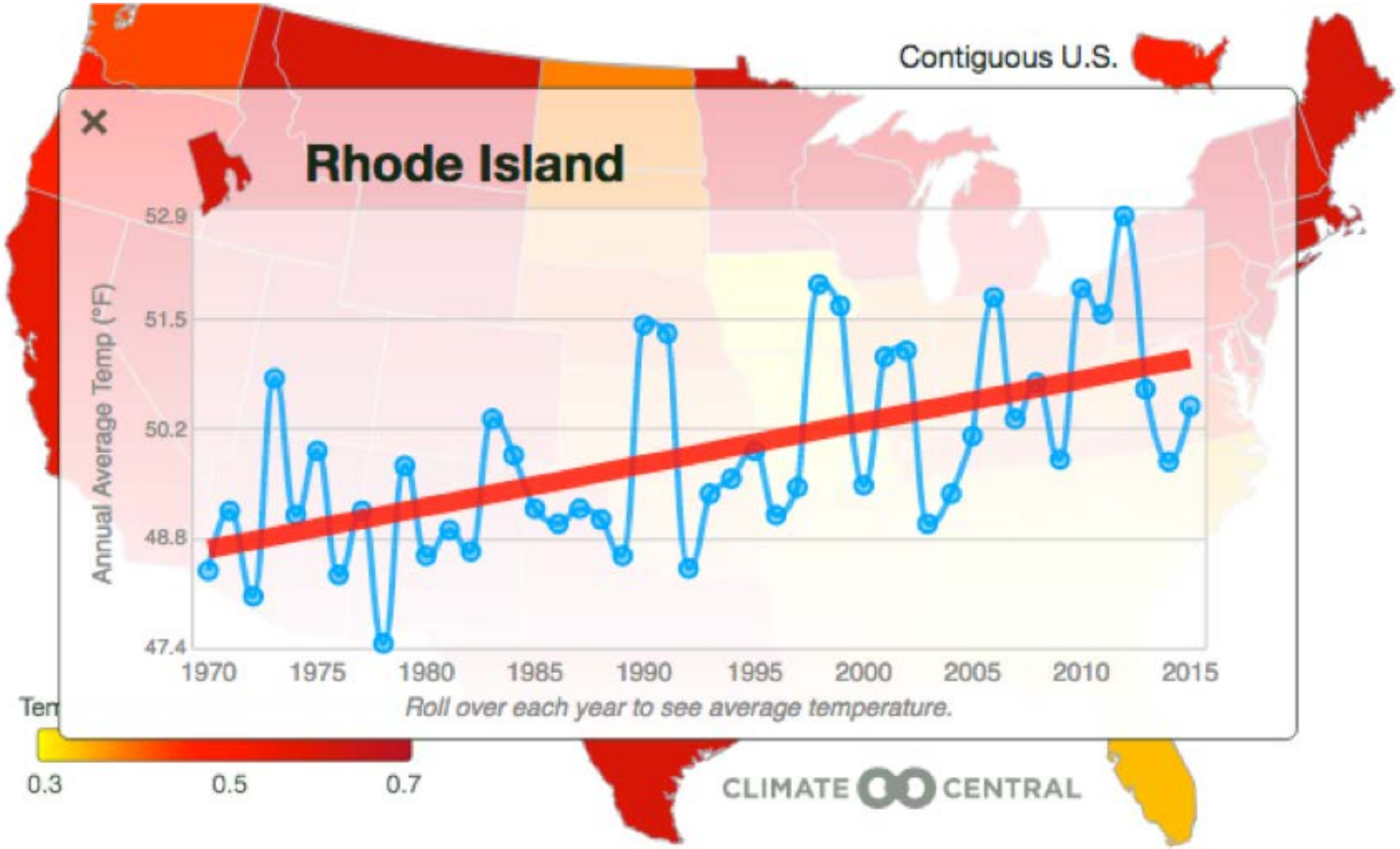

https://www3.epa.gov/climatechange/images/impacts-adaptation/WaterCycleChanges.jpg

# In the News

"New England is likely to experience significantly greater warming over the next decade, and beyond, *than the rest of the planet*, according to new findings by climate scientists at the University of Massachusetts Amherst"

Boston Globe - January, 2017

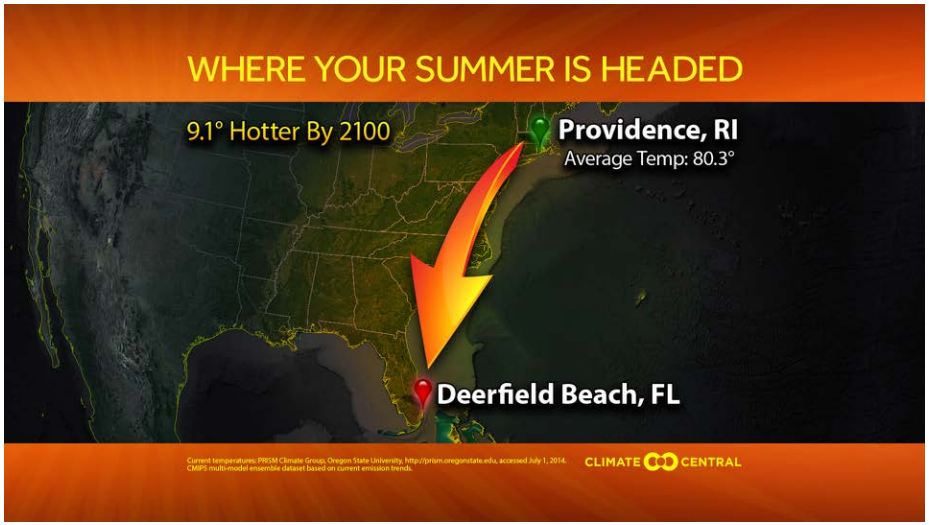
# Rhode Island's Average Annual Temp Increasing Steadily Since 1970



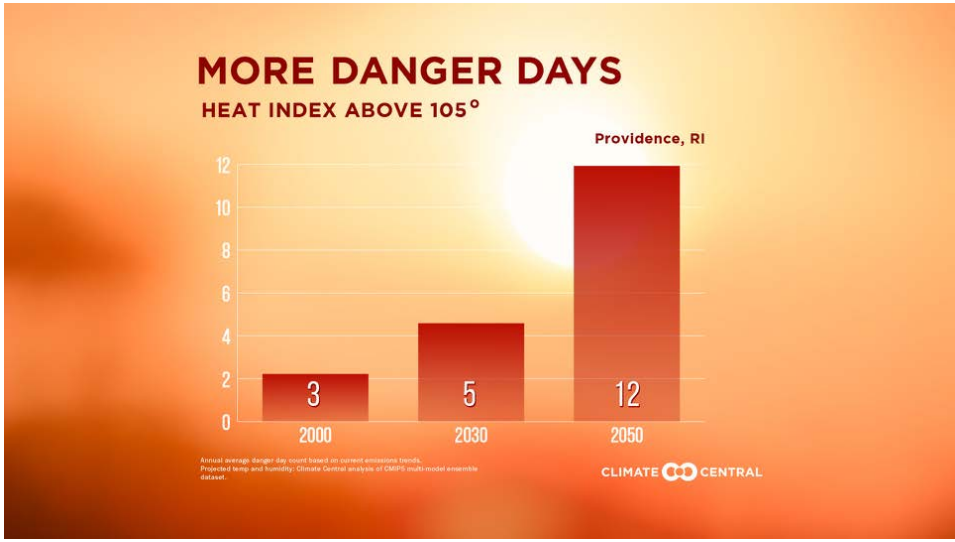

http://statesatrisk.org/rhode-island/extreme-heat.

# Rhode Island's Shifting Summers

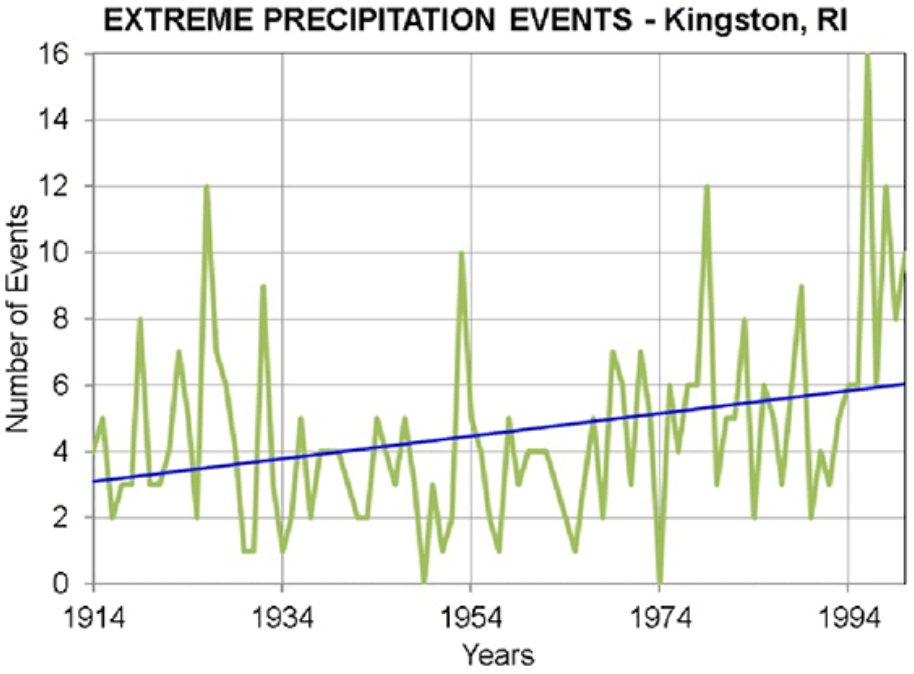
- Warmer winters
  - 8 to 12 degrees
- Shorter winters
  - one to two weeks
- More summer days
  - 20 more
  - Days over 100 degrees
- Earlier summers
  - 3 weeks earlier



# More Days Over 95 degrees



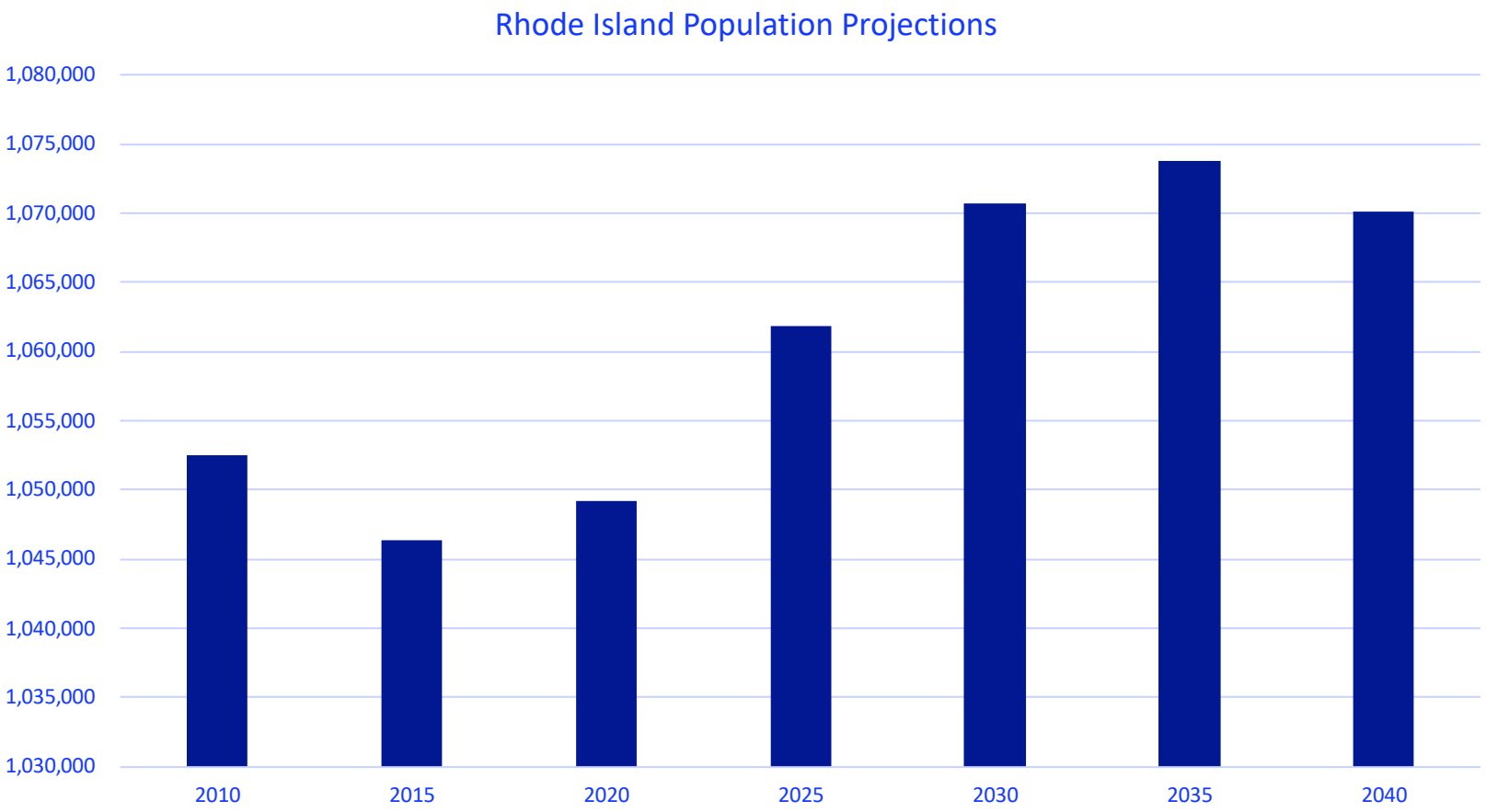
# Extreme Precipitation Events

| Water Utility | Drought | Sea Level Rise | Coastal Flooding | Riverine Flooding | Hurricane |
|---|---|---|---|---|---|
| Block Island Water Works | - | 3 | 1 | 0 | 1 |
| Bristol County Water Authority | 1 | 4 | 4 | 0 | 4 |
| Cumberland Water Department | 1 | 0 | 0 | 4 | 0 |
| East Providence Public Works | 2 | 4 | 2 | 0 | 2 |
| East Smithfield Water District | 4 | 0 | 0 | 2 | 0 |
| Greenville Water District | 4 | 0 | 0 | 1 | 0 |
| Harrisville Fire District Water Department | 1 | 0 | 0 | 3 | 0 |
| Jamestown Water Division | 0 | 4 | 4 | 0 | 4 |
| Johnston Water Control Facility | 3 | 0 | 0 | 2 | 0 |
| Kent County Water Authority | 0 | 3 | 2 | 4 | 1 |
| Kingston Water District | 0 | 0 | 1 | 3 | 1 |
| Lincoln Water Commission | 3 | 0 | 0 | 4 | 0 |
| Narragansett Water Department - North | 0 | 3 | 2 | 2 | 4 |
| Narragansett Water Department - South | 0 | 4 | 4 | 0 | 2 |
| Newport Water Division | 2 | 4 | 4 | 0 | 4 |
| North Kingstown Water Department | 1 | 3 | 4 | 4 | 4 |
| North Smithfield Water Department | - | 0 | 0 | 2 | 0 |
| North Tiverton Fire District | 4 | 2 | 2 | 3 | 2 |
| Pascoag Utility District | 0 | 0 | 0 | 2 | 0 |
| Pawtucket Water Supply Board | 2 | 4 | 2 | 3 | 2 |
| Portsmouth Water District and Fire District | 3 | 3 | 4 | 0 | 4 |
| Providence Water Supply Board | - | 4 | 2 | 4 | 4 |
| Rhode Island Economic Development Corporation | - | 4 | 2 | 4 | 2 |
| Richmond Water Supply System | - | 0 | 0 | 1 | 0 |
| Smithfield Water Supply Board | 3 | 0 | 0 | 1 | 0 |
| South Kingstown Water District–Middlebridge | 1 | 4 | 4 | 2 | 4 |
| South Kingstown Water District | 1 | 4 | 4 | 3 | 4 |
| Stone Bridge Fire District and Water Department | 2 | 4 | 4 | 0 | 4 |
| Tiverton Water District | - | 0 | 2 | 0 | 1 |
| University of Rhode Island | 4 | 0 | 0 | 1 | 1 |
| United Water Rhode Island | - | 4 | 4 | 0 | 4 |
| Warwick Water Division | 3 | 4 | 4 | 4 | 4 |
| Westerly Water Department | 1 | 4 | 3 | 2 | 4 |
| Woonsocket Public Works Department | 3 | 0 | 0 | 3 | 0 |

http://www.health.ri.gov/publications/reports/2013EnsuringSafeWaterForRhodeIslandsFuture.pdf

# Population Change as a Stressor




http://www.planning.ri.gov/documents/census/tp162.pdf

| CITY/TOWN, cont. | Historic | Projected | | | | | |
|---|---|---|---|---|---|---|---|
| | '05-'10 | '10-'15 | '15-'20 | '20-'25 | '25-'30 | '30-'35 | '35-'40 |
| Central Falls | -0.7% | 0.1% | 1.1% | 2.0% | 1.6% | 1.0% | 0.4% |
| Charlestown | -2.2% | 3.3% | 2.9% | 3.7% | 3.3% | 2.7% | 2.0% |
| Coventry | -0.6% | 1.2% | 1.9% | 2.8% | 2.4% | 1.8% | 1.1% |
| Cranston | -1.2% | -0.6% | 0.4% | 1.3% | 1.0% | 0.4% | -0.2% |
| Cumberland | 0.9% | 1.3% | 2.2% | 3.1% | 2.7% | 2.1% | 1.4% |
| E. Greenwich | -1.0% | 0.9% | 1.5% | 2.4% | 2.0% | 1.4% | 0.7% |
| E. Providence | -3.2% | -3.6% | -2.5% | -1.6% | -2.0% | -2.5% | -3.2% |
| Exeter | 1.0% | 2.3% | 3.0% | 3.9% | 3.4% | 2.8% | 2.0% |
| Foster | 1.9% | 0.6% | 1.9% | 2.7% | 2.4% | 1.7% | 1.1% |
| Glocester | -2.3% | 0.2% | 0.5% | 1.4% | 1.0% | 0.5% | -0.2% |
| Hopkinton | 0.2% | 1.9% | 2.6% | 3.5% | 3.1% | 2.5% | 1.8% |
| Jamestown | -2.1% | 0.8% | 0.6% | 1.6% | 1.2% | 0.6% | 0.0% |
| Johnston | -0.6% | 0.0% | 0.9% | 1.8% | 1.5% | 0.9% | 0.2% |
| Lincoln | -1.0% | 1.6% | 2.0% | 2.9% | 2.5% | 1.9% | 1.2% |
| Little Compton | -1.6% | -0.6% | -0.2% | 0.8% | 0.4% | -0.1% | -0.8% |
| Middletown | -3.4% | -5.4% | -4.5% | -3.7% | -4.1% | -4.8% | -5.5% |
| Narragansett | -3.4% | 0.4% | 0.4% | 1.3% | 1.0% | 0.4% | -0.2% |
| New Shoreham | -0.1% | 4.0% | 3.9% | 4.7% | 4.2% | 3.6% | 2.8% |
| Newport | -2.4% | -5.3% | -4.3% | -3.5% | -3.9% | -4.5% | -5.2% |
| No. Kingstown | -1.7% | 1.8% | 2.3% | 3.2% | 1.7% | 1.1% | 0.5% |
| No. Providence | -2.1% | -1.5% | -0.6% | 0.3% | -0.1% | -0.6% | -1.2% |
| No. Smithfield | 3.7% | -0.2% | 2.1% | 3.0% | 2.6% | 2.0% | 1.3% |
| Pawtucket | -2.6% | -2.2% | -1.3% | -0.4% | -0.7% | -1.3% | -1.9% |
| Portsmouth | 0.5% | -0.5% | 0.4% | 1.3% | 1.0% | 0.4% | -0.3% |
| Providence | -0.7% | 0.2% | 1.2% | 2.1% | 1.7% | 1.1% | 0.5% |
| Richmond | 0.4% | 6.3% | 5.9% | 6.7% | 6.2% | 5.4% | 4.6% |
| Scituate | -0.9% | -0.1% | 0.5% | 1.5% | 1.1% | 0.5% | -0.1% |
| Smithfield | -0.6% | 1.0% | 1.8% | 2.7% | 2.3% | 1.7% | 1.0% |
| So. Kingstown | 4.0% | 3.2% | 3.6% | 4.4% | 4.0% | 3.3% | 2.6% |
| Tiverton | 1.3% | 0.3% | 1.3% | 2.2% | 1.8% | 1.3% | 0.6% |
| Warren | -5.1% | -3.1% | -2.6% | -1.7% | -2.1% | -2.6% | -3.2% |
| Warwick | -3.6% | -2.5% | -1.7% | -0.8% | -1.1% | -1.7% | -2.3% |
| West Greenwich | 6.9% | 7.8% | 8.0% | 8.2% | 7.2% | 6.1% | 5.0% |
| West Warwick | -2.0% | -1.6% | -0.8% | 0.2% | -0.2% | -0.7% | -1.4% |
| Westerly | -2.3% | -0.1% | 0.4% | 1.4% | 1.0% | 0.4% | -0.2% |
| Woonsocket | -3.9% | -3.7% | -2.7% | -1.9% | -2.2% | -2.8% | -3.4% |

Figure 13. Projected Five-Year Growth Rate for State and Cities and Towns, 2010-2040

# Other Types of Stressors

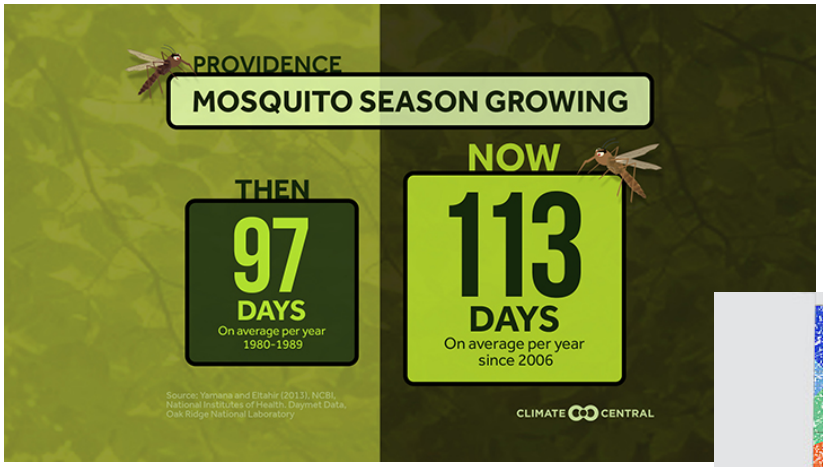
- Uncertain political and economic future
- Underfunded infrastructure maintenance
- Understaffed of lack of workforce

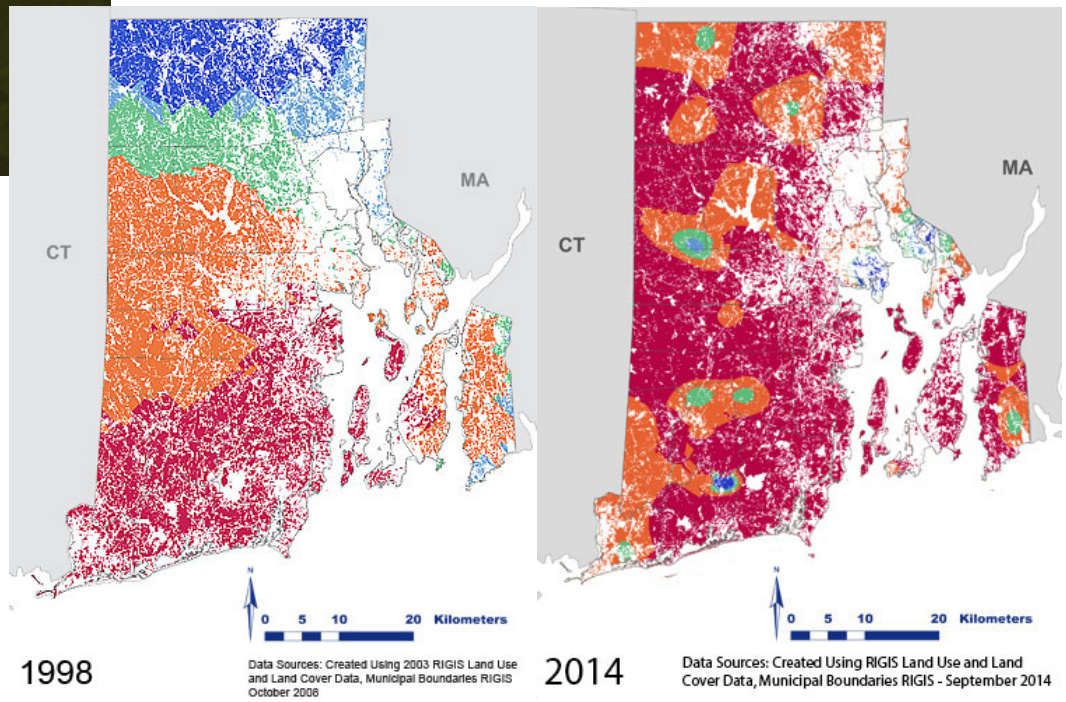
- What other stressors can you think of?

# Exploring Future Impacts


Extreme heat and declining air quality pose serious health concerns

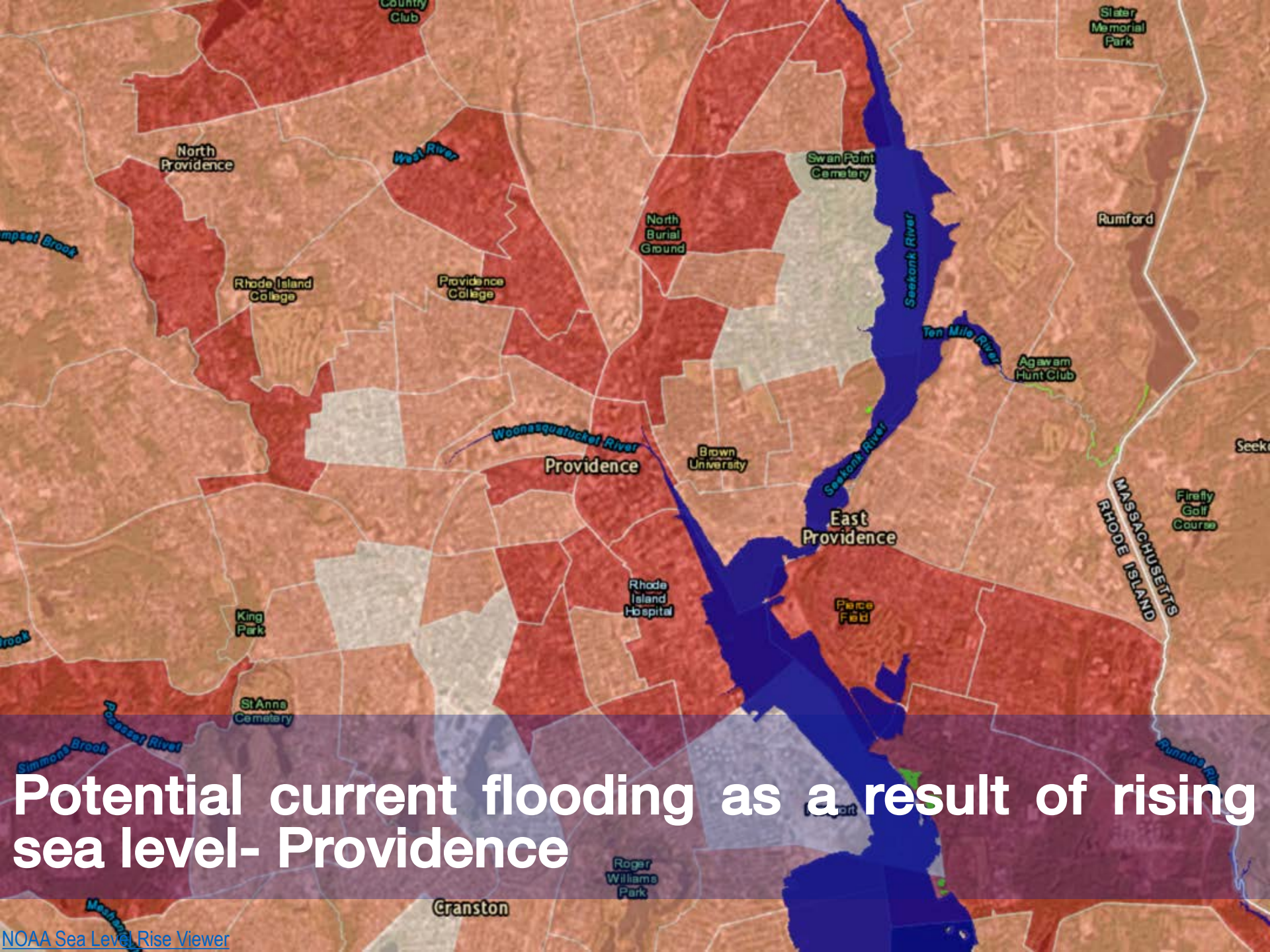
# Mosquitos and Ticks on the Rise




Rhode Island TickEncounter Risk Map, 1994-2014


# Changing Agriculture and Fisheries




# Potential current flooding as a result of rising sea level- Providence

NOAA Sea Level Rise Viewer

# The changing Gulf of Maine

A lucky confluence of factors – cold water, powerful tides, bountiful rivers, an extensive coastline and a nutrient-stirring gyre of currents – has made the gulf a life-making machine. But the sea has been warming, causing trouble for many cold-loving species that live here and fostering an influx of sometimes troublesome creatures from southern climates.


**1 Salmon** – Some experts think warming will doom the endangered fish in Maine and the Maritimes, despite dam removals on the Penobscot and other rivers.



**2 Green crabs** – This invader, whose populations explode in warm waters, harms native species by destroying clam beds and eelgrass meadows.



**3 Right whales** – This endangered species has been abandoning its summer feeding grounds off Grand Manan for lack of food: copepods.



**4 Blue crabs** – A Chesapeake Bay delicacy, this warm-water species has established itself at Kejimkujik National Park in Nova Scotia.



**Mussels** – Native species faces double threat as it falls prey to green crabs and acidification weakens its shells and its ability to create anchoring threads.



**5 Puffins** – The population at Eastern Egg Rock crashed for lack of food during the "ocean heat wave" of 2012. Hatchlings have been getting thinner over the past decade.



**6 Black sea bass** – This warm-water species, which preys on lobster, has been appearing in greater numbers in the gulf.



**7 Longfin squid** – Another warm-water lover, possibly providing a future fishery, has been laying its eggs along the Maine coast.



**8 Oysters** – Hatchlings are failing in large numbers as intensifying storms contribute to increasingly acidic coastal waters..



**9 Soft-shell clams** – In addition to weaker shells because of acidification, the native species has been devastated by green crab hordes in Freeport and Brunswick.



**11 Cod** – One of many cold-water species that have been retreating into the coldest parts of the gulf, the deep bottoms in the southwest.



**10 Asian shore crabs** – Now dominant along New Hampshire's seacoast, it's heading east.

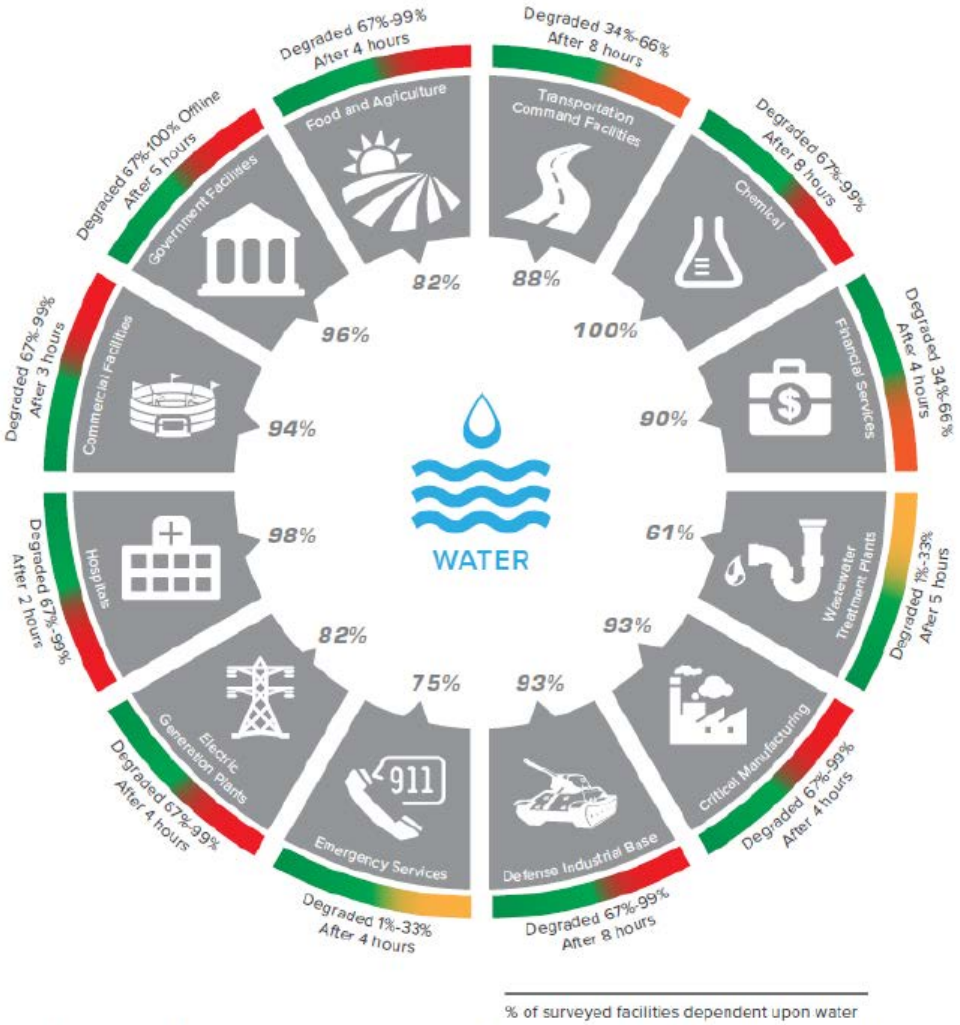


**12 Lobster** – The species has not only abandoned southern New England as it shifts ever eastward, It also faces a growing threat from shell disease.

STAFF RESEARCH: Colin S. Woodard

STAFF GRAPHIC | MICHAEL FISHER

# Impacts to Critical Infrastructure with Loss of Water systems

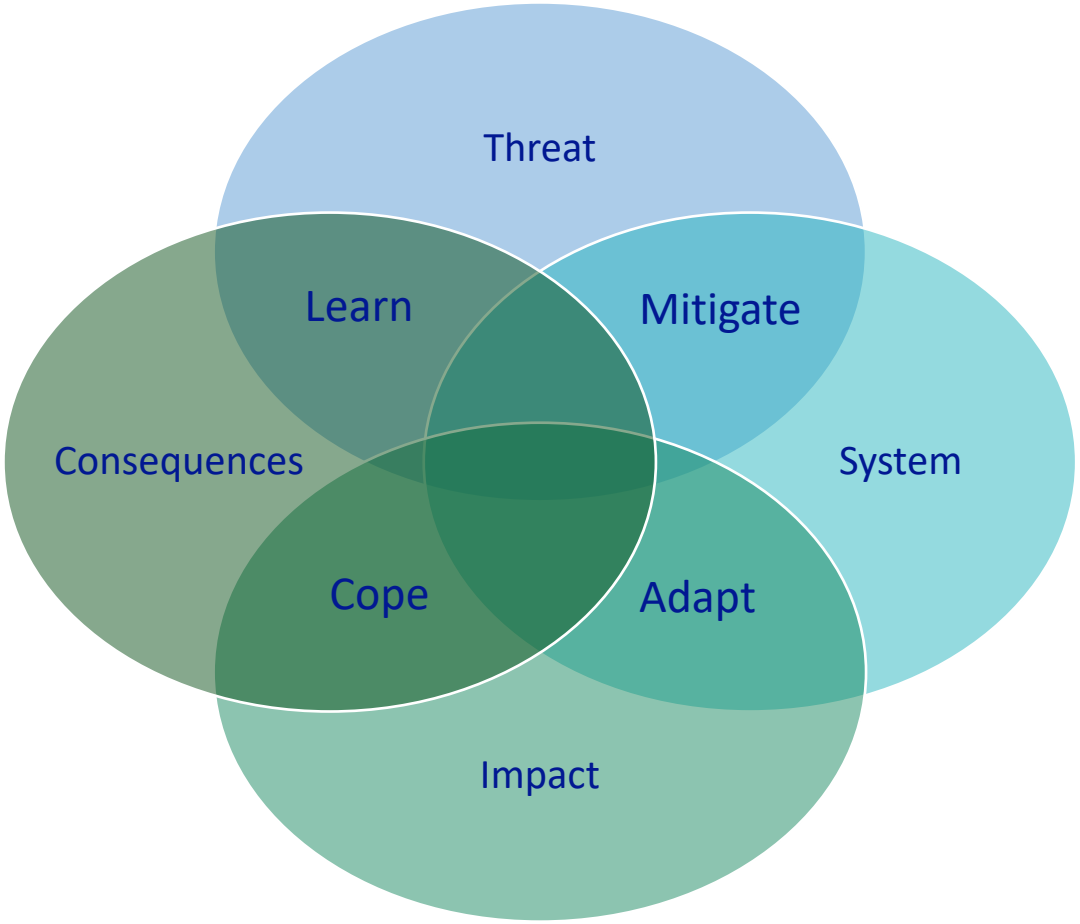



**Note:** This data represents a majority (60 percent or greater) dependence on water.

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

# Safe and SuRe Approach




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

# 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 |

↓

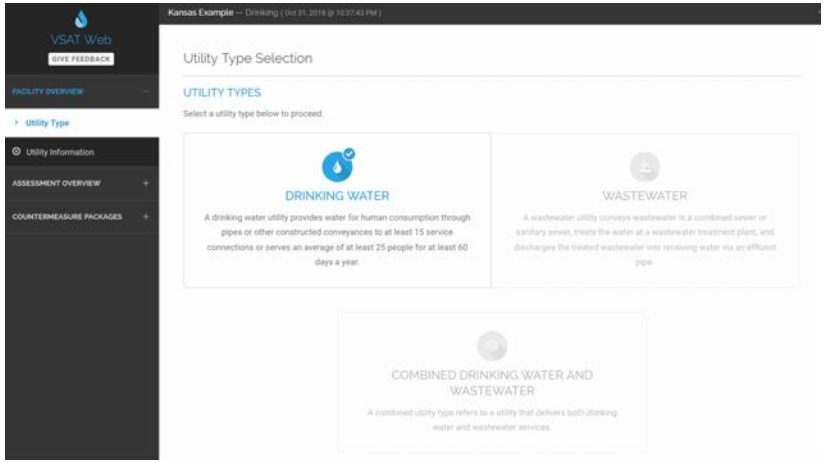
| Consequences | | | |
|---|---|---|---|
| Property Damage | Loss of Earnings | Injury | Disease |

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

# Assessing Vulnerabilities

# 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

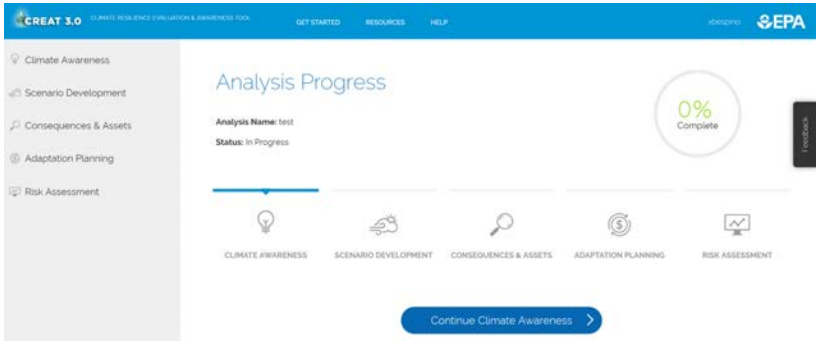
- Threat = any event that could impair utility
  - Natural disasters, cyber-attacks, vandalism, power outage, etc.
- Vulnerability = likelihood of damage if a specific threat occurs
- Consequences = adverse impacts that result when a threat causes damage to a utility asset
  - Economic costs, equipment 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