



Resilience Planning and Adaptation Training for Water and Wastewater Utilities

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<https://creat.epa.gov/creat>



Resilience Planning and Adaptation Training for Water and Wastewater Utilities

Welcome, Workshop Objectives & Agenda June 22, 2017

Robert Wither, New York Water Environment Association

Ashley Greene, U.S. EPA Headquarters

Alexi Remnek, U.S. EPA Region 2

Alfredo Lagos, CSRA

Workshop Objectives

- Better understand and plan for the impacts of current and future weather conditions in order to protect utility infrastructure and ensure the continued provision of clean and safe water to customers;
- Begin the process of conducting a risk assessment using the Climate Resilience Evaluation and Awareness Tool (CREAT); and
- Identify and share information on adaptation strategies to build utility long-term resilience.

Training Agenda

Time	Event
8:30 a.m.	Welcome, Agenda Review and Participant Introductions <i>Robert Wither, New York Water Environment Association</i> <i>Ashley Greene, U.S. EPA Headquarters</i> <i>Alexi Remnek, U.S. EPA Region 2</i>
9:00 a.m.	Presentation: CREAT Overview
9:10 a.m.	Presentation: Regional Extreme Weather Projections and Water Sector Impacts <i>David Eichorn, State University of New York College of Environmental Science and Forestry</i>
9:30 a.m.	Presentation: Adaptation Utility Case Study <i>Cathy Young, Binghamton Johnson City Joint Treatment Plant (INVITED)</i>
10:00 a.m.	CREAT Module 1: Climate Awareness
10:30 a.m.	Break
10:45 a.m.	CREAT Module 2: Scenario Development
11:30 a.m.	CREAT Module 3: Consequences & Assets

Training Agenda

Time	Event
12:00 p.m.	Lunch (will be provided on-site for purchase)
1:00 p.m.	CREAT Module 4: Adaptation Planning, Part 1
1:20 p.m.	Small Groups and Discussion: Identifying and Prioritizing Potential Adaptive Measures
2:20 p.m.	Break
2:30 p.m.	CREAT Module 4: Adaptation Planning, Part 2
3:00 p.m.	CREAT Module 5: Risk Assessment
3:40 p.m.	Presentation: Funding Resilience and Adaptation <i>Khristopher Dodson, Syracuse University Environmental Finance Center</i>
4:15 p.m.	Workshop Wrap-Up
4:30 p.m.	Adjourn



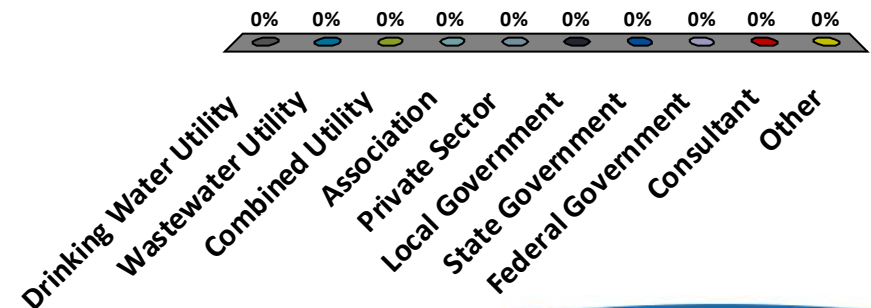
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Introductions and Perspectives on Extreme Events

Alfredo Lagos, CSRA

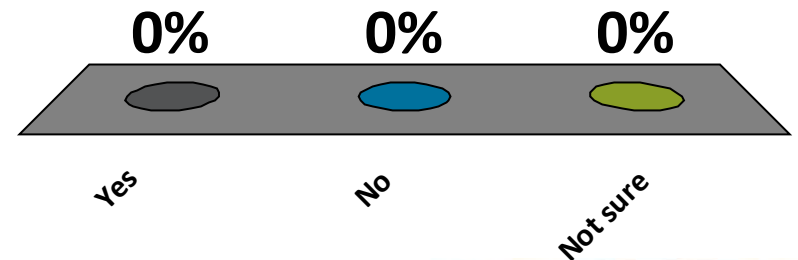
What group do you represent?

1. Drinking Water Utility
2. Wastewater Utility
3. Stormwater Utility
4. Combined Utility
5. Association
6. Private Sector
7. Local Government
8. State Government
9. Federal Government
10. Consultant
11. Other



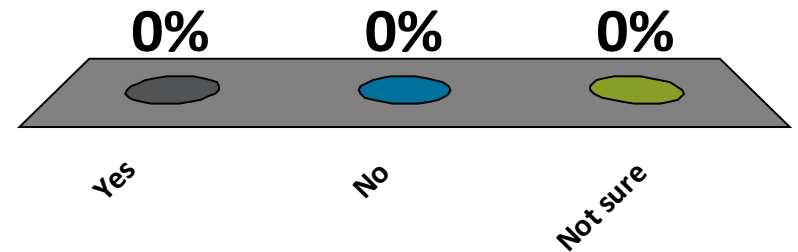
Have you conducted any extreme event or climate adaptation planning at your organization?

1. Yes
2. No
3. Not sure



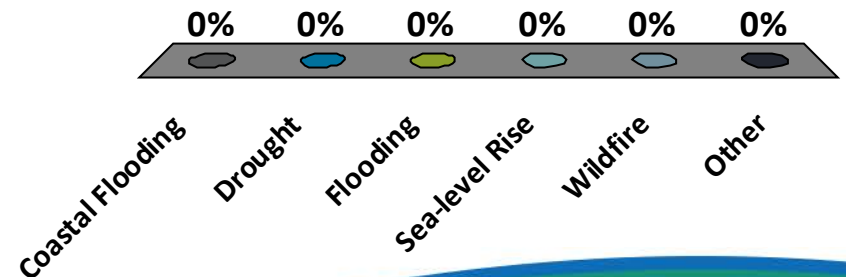
Have you ever used CREAT or any other USEPA Creating Resilient Water Utilities (CRWU) resource before?

1. Yes
2. No
3. Not sure



What potential extreme weather or future environmental condition impact are you most concerned about at your organization?

1. Coastal Flooding
2. Drought
3. Flooding
4. Sea-level Rise
5. Wildfire
6. Other



Introductions

- Name
- Title
- Affiliation
- Brief statement about your experience with or concerns about extreme events or potential environmental impacts to your utility, organization, or location

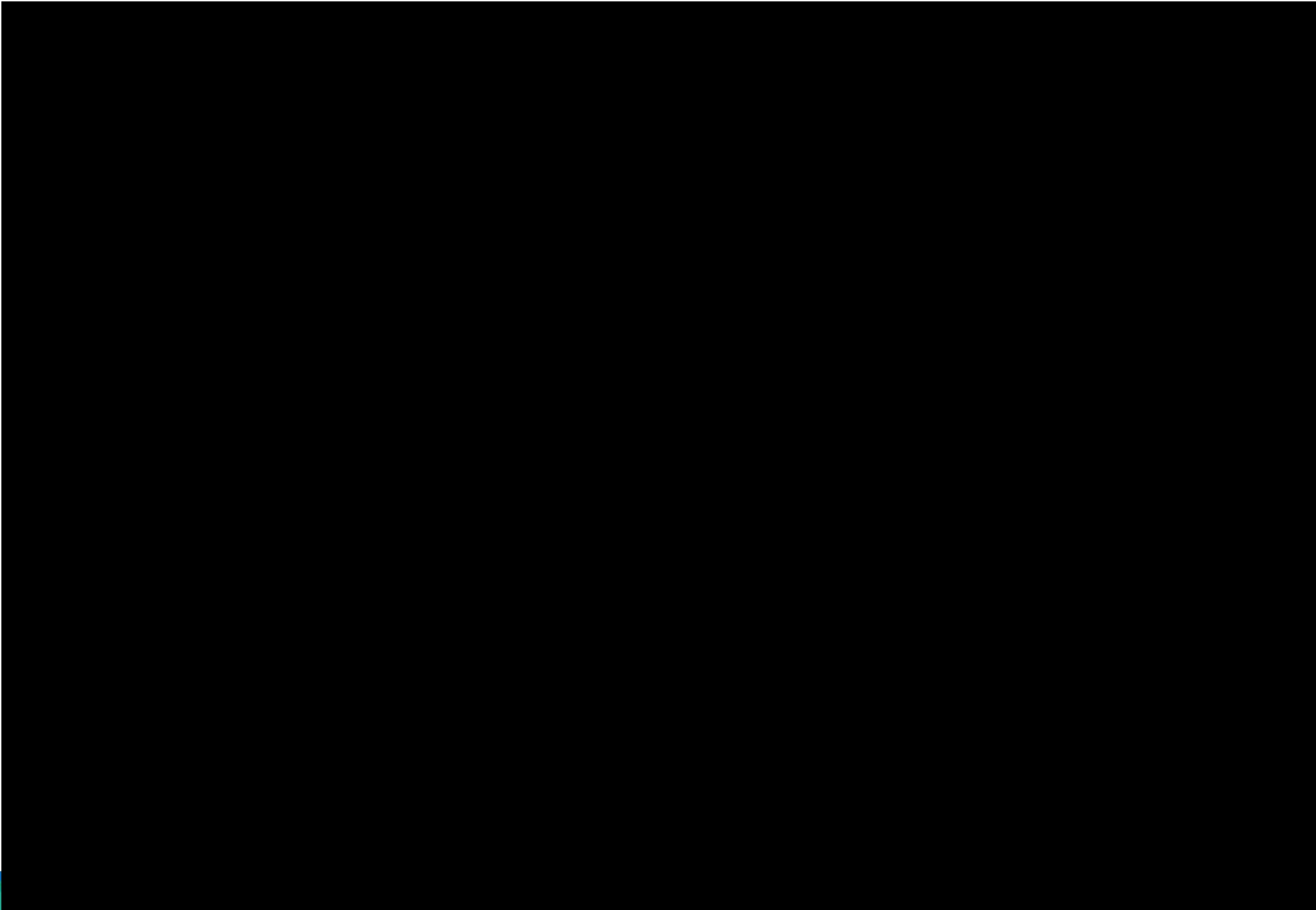


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CREAT Overview

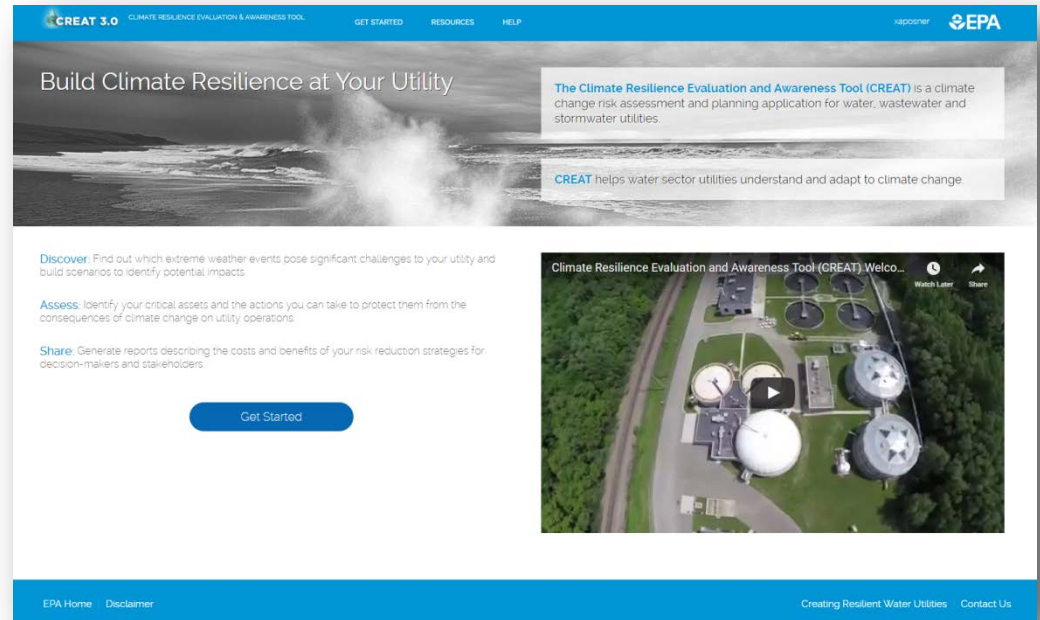
Amy Posner, CSRA

CREAT Welcome Video



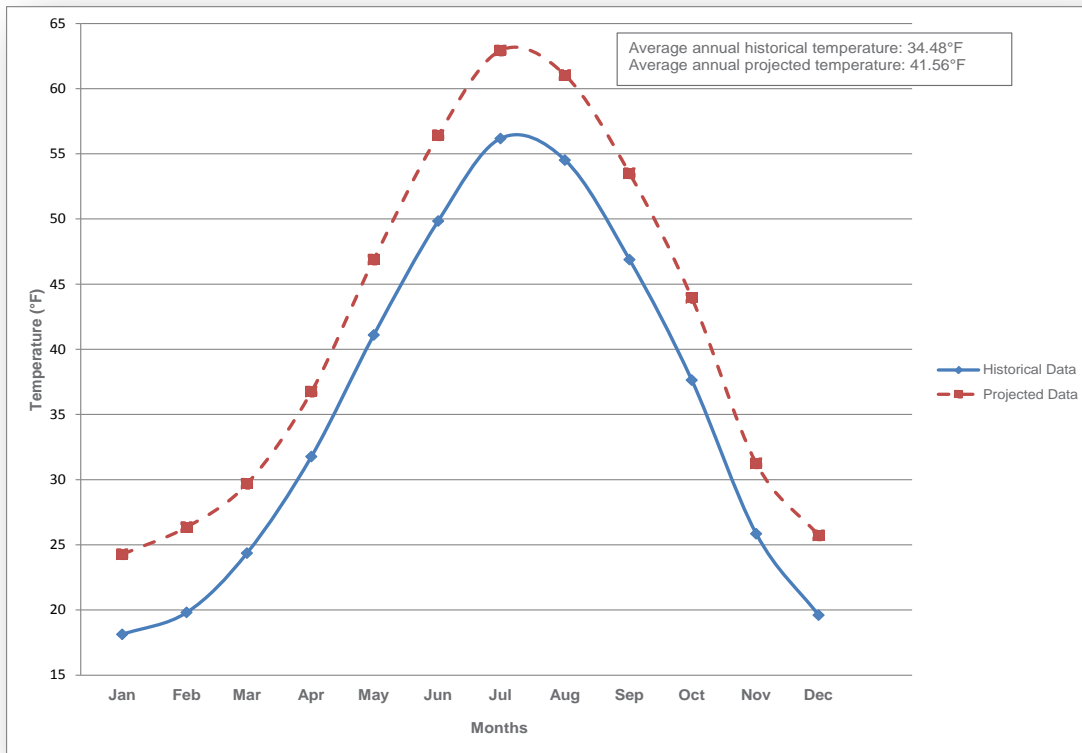
CREAT Overview

- Easy to use
- Decision support tool
- Step by step process
- Up to date climate data
- Streamlined analysis option



What will the future look like?

- Identify threats and learn how they might change over time



- Projected climate data to help guide this thought exercise

What can I do to protect critical infrastructure and utility operations?

- Learn about the potential consequences to business revenue, equipment damage and changes in water quality and quantity
- Identify adaptation strategies for additional resilience

CREAT Adaptive Measures Library (Step 1 of 2)

Choose an adaptive measure from the CREAT provided library. Choose an adaptive measure from the CREAT-provided library below, then click "Next" to refine your selection.

CONSTRUCT

ALTERNATE WASTEWATER / STORMWATER CAPABILITIES

SELECT



BACK-UP POWER

SELECT



FACILITY LOCATION

SELECT



HYDROLOGIC BARRIER

SELECT



INCREASED CAPACITY - WASTEWATER / STORMWATER

SELECT



LEVEE

SELECT

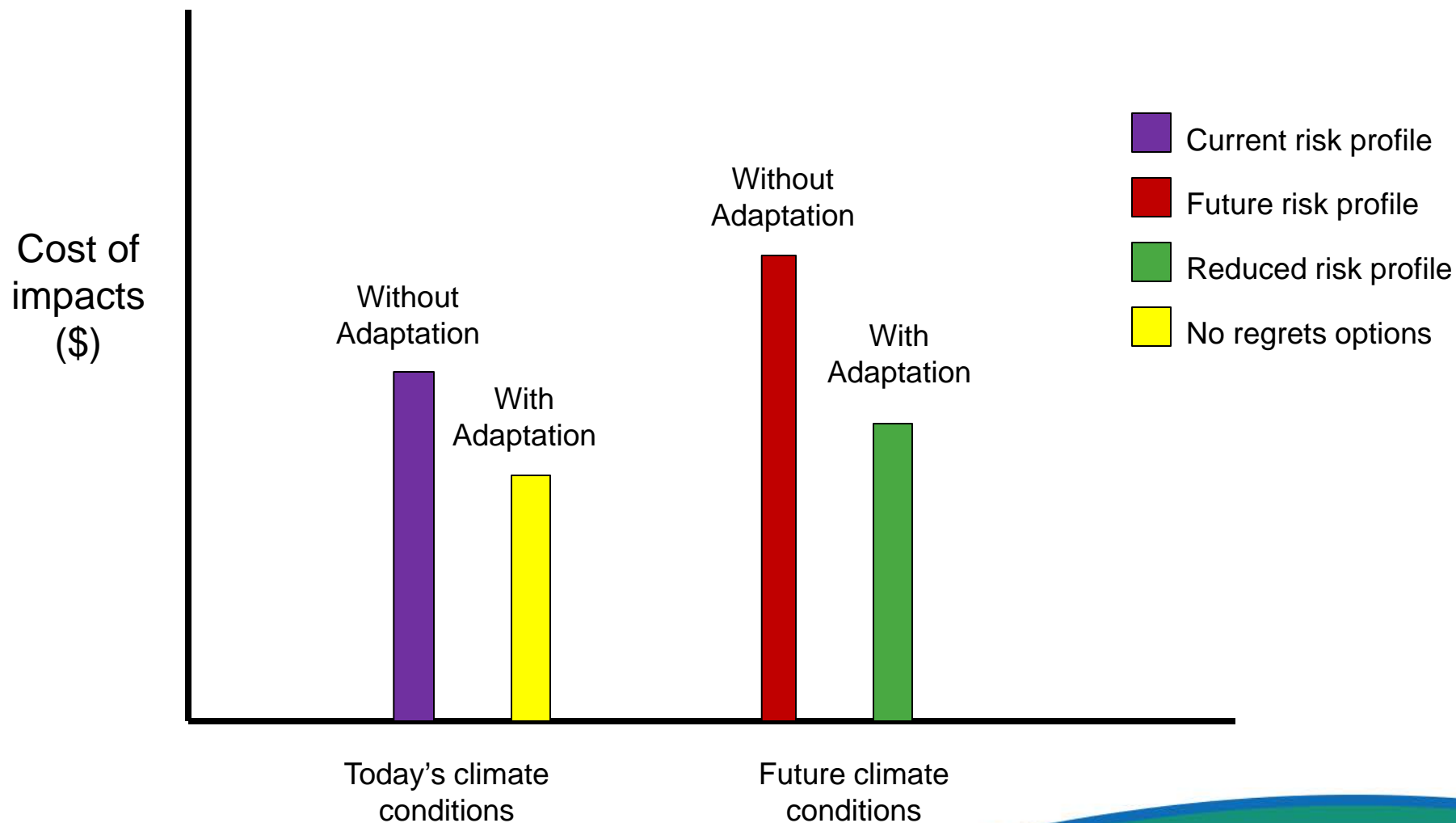


LOW-HEAD DAM

SELECT



CREAT in a Bar Graph



How do I decide which measures to implement?

Cost to adapt

Cost of impacts

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Are these strategies beneficial to implement?

- **Consider the likelihood that the threats will occur**
 - Are your adaptation strategies still cost effective?
 - Are some of your strategies “No regrets” strategies?
- **Identify external impacts of implementation**
 - Will my energy costs go up?
 - What funding sources are available? How can I minimize the costs that get passed on to my customers?
 - Do any of the strategies call for water conservation that might impact other sectors?

CREAT Outputs

- Interim summary reports
- Data exports
- Plan report

Climate Awareness Report

Potential future climate conditions for Toms River

Climate change presents challenges to water, wastewater and stormwater utilities and the communities they serve. Those utilities that adapt to these changes may need to raise rates to develop new water supplies and adjust their treatment and operations. Without adaptation, infrastructure and operations designed for historical climate conditions could be overwhelmed or damaged. Main breaks, overflows, and service outages would lead to lost local business revenue and public health concerns. Several changes are possible for your utility's location and each future has unique challenges to consider:

	What if the climate were significantly hotter?	5.51°F increase in average annual temperature and 6.02 days over 100 °F per year by 2060
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- Adjust treatment processes to warmer waters and water quality
- Utility crews and equipment stressed during hot weather

What if the climate were significantly wetter?

- Strained reservoirs, overwhelmed treatment facilities during sustained and intense storm events
- Adjust treatment processes to lesser quality water and soil erosion and contaminants from overland runoff

What if the climate were significantly colder?

- Revenue loss from reduced usage during voluntary conservation actions in response to cold weather
- Operational changes to increase efficiency, conserve energy and access alternate supplies during intense cold weather

How will rising sea level affect our coastal assets?

- Frequent flooding during storms due to higher storm surges
- Coastal aquifers more vulnerable to saline intrusion from higher sea level

CREAT WWTP protection measures Plan Report TOMS RIVER

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Attachment D – Likelihood Sensitivity.....	8

Background

This report summarizes the potential for reducing consequences that Toms River may experience due to current and projected climate conditions. These consequences are the foundation of the risk that climate conditions may pose to those assets defined as vulnerable by the assessor.

System type	Combined Wastewater
Volume treated (Million Gallons per Day)	35
Population served	95,000

The focus of this report is the WWTP protection measures, defined as the following: This plan includes all measures that would protect the WWTP from coastal storm surges and sea level rise. In each case, where consequences were assessed, the potential gains of implementing this plan were determined in comparison to current resilience to these same conditions. The ability to protect assets today is described in the Current Measures plan, where those practices and infrastructure protections that currently exist provide some level of consequence reduction in the face of assessed threats.

For each asset, a guided risk assessment was conducted based on the occurrence of multiple scenarios of the same threat; please see Attachment A. For example, the possible consequences to a pump station due to flooding could be assessed across several scenarios of historical or projected changes in precipitation. The time period over which to consider both threats and the ability to implement plans is a critical component of this assessment. The time period selected for this analysis was from 2016 to 2100, which aligns with the 2060 projected climate and sea level data provided in CREAT.

The types of consequences considered by the assessor in the risk assessment summarized in this report were selected based on the types of losses anticipated for those threats and assets being considered; please see Attachment B. For each type of economic consequence, a monetary scale was selected to define levels of consequence to use during risk assessment.

Who uses CREAT and for what purposes?

- **Inform Planning Efforts**

- A large drinking water utility in the Southwest used CREAT to conduct a full risk assessment to determine the potential impacts of extreme drought on its operations and identify adjustments to management of future water supplies
- A group of small drinking water utilities on the West Coast used CREAT to assess changes in saline intrusion to their aquifers and impacts on future water rights
- A small drinking water utility on the West Coast is using CREAT to assess risks from drought and changes in water quality, and potentially losing access to their primary water supply

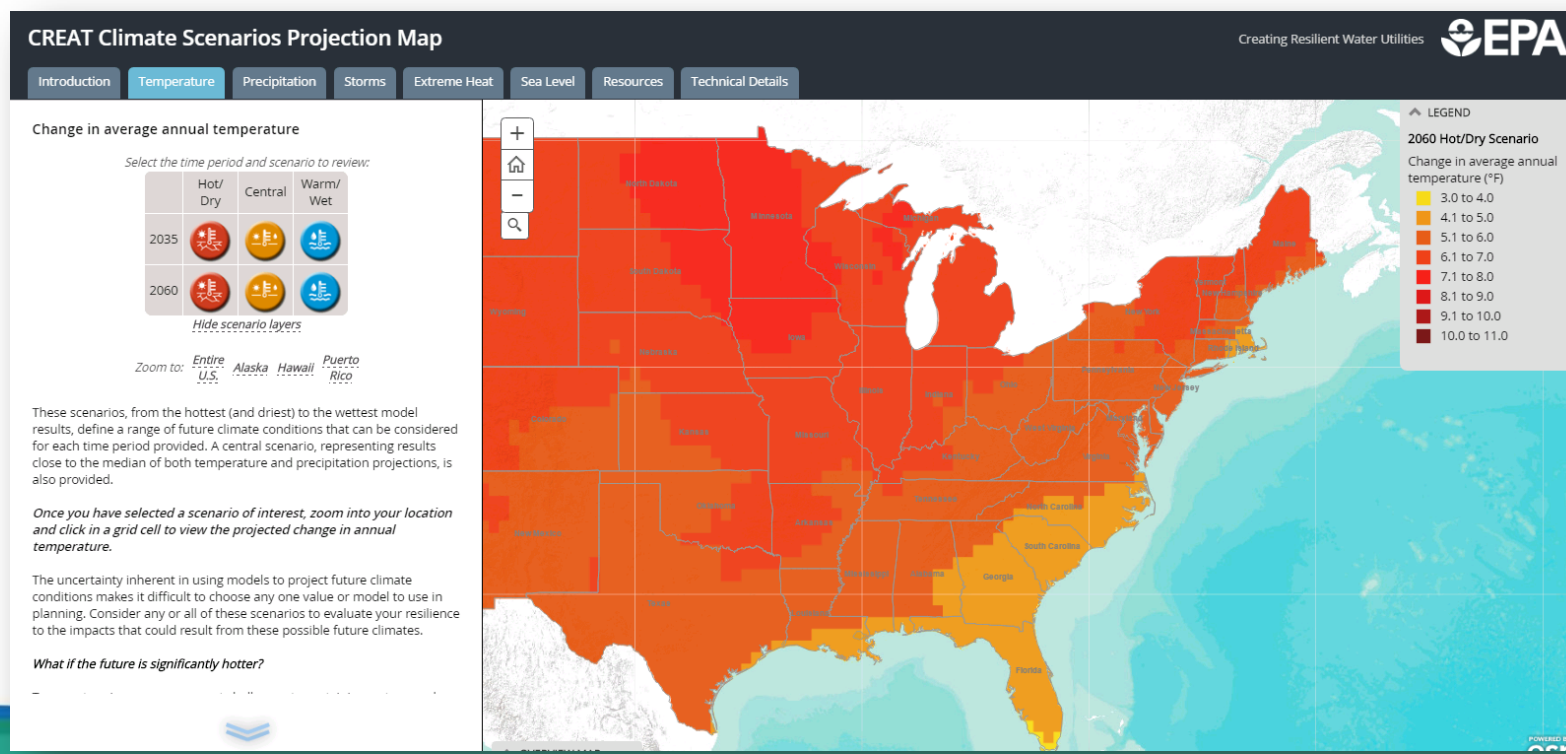
- **Justify Funding Requests** - A large wastewater utility on the East Coast is using CREAT to evaluate and justify funding for a sea wall to protect their facilities from coastal storm surge

Who should I include in my CREAT assessment?

- **Project lead**
- **Assessment team**
 - Operations staff
 - Planning staff
 - Finance staff
 - Climate scientists
 - State or federal funding organizations
 - Other nearby utilities

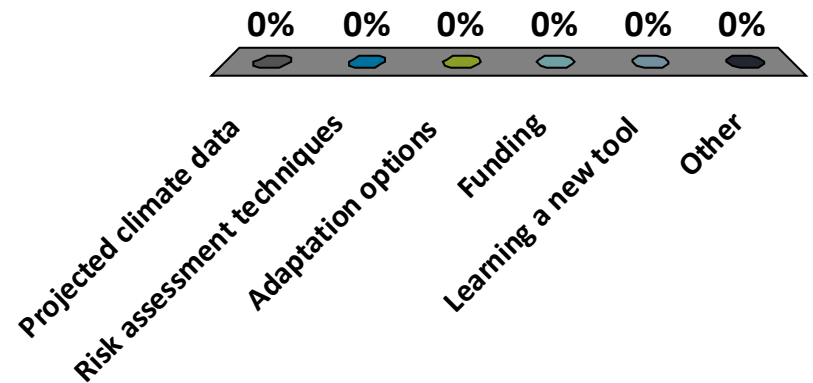
What information should I have before I start my CREAT assessment?

- Assessment priorities and goals
- Review utility information
 - Critical assets
 - Impacts from past extreme events
 - Climate and weather data
- Review the CREAT Climate Scenarios Projection Map



What topic do you most want to learn about today?

1. Projected climate data
2. Risk assessment techniques
3. Adaptation options
4. Funding
5. Learning a new tool
6. Other





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Regional Extreme Weather Projections and Water Sector Impacts

**David Eichorn, State University of New York College of Environmental
Science and Forestry**



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Adaptation Utility Case Study: Binghamton Johnson City

Cathy Young, Binghamton Johnson City Joint Treatment Plant (INVITED)

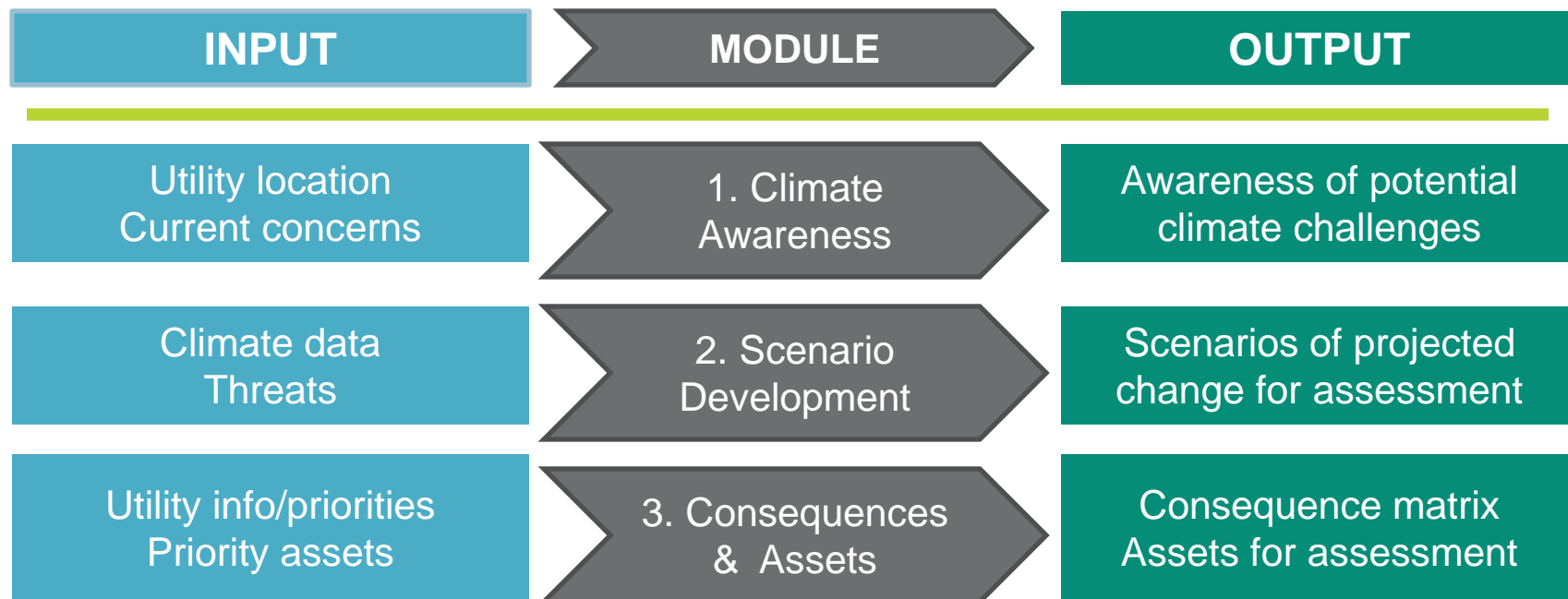


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CREAT Training

Amy Posner, CSRA

CREAT process overview



CREAT process overview



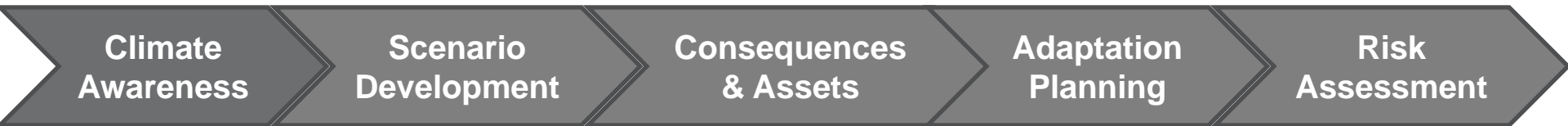


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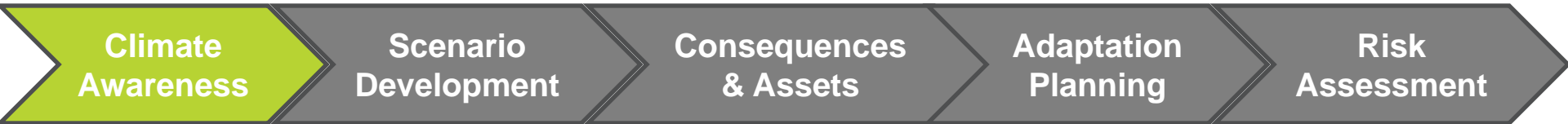
CREAT Training Module 1: Climate Awareness

Alfredo Lagos, CSRA

Climate Resilience Evaluation and Awareness Tool (CREAT)



Step 1 in the Risk Assessment Process



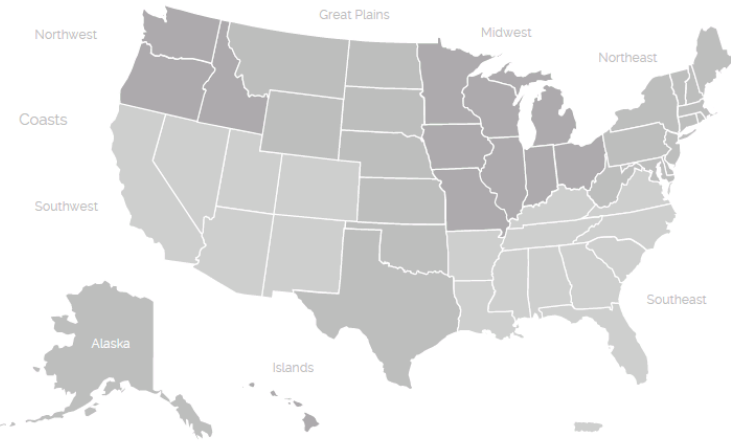
This module provides basic information about climate impacts and allows you to enter general information about your utility

Module 1: Climate Awareness

Goal: Increase awareness of climate impacts for your utility's location to help inform future assessment inputs and decisions

Climate Change Basics

Click on any region in the map below to learn about climate change impacts in that area. You can also review national or coastal climate impacts and learn about how climate change is expected to impact a specific sector by clicking on the Topic Links.



Topic Links

- [National](#)
- [Sea Level Rise](#)
- [Agriculture](#)
- [Human Health](#)
- [Coasts](#)
- [Water](#)
- [Transportation](#)
- [Rural Communities](#)
- [Extreme Weather](#)
- [Energy](#)
- [Forest](#)
- [Ecosystems](#)

Note: Map and Topic Links open in a new window or tab in your web browser.

Example utility for CREAT analysis

- Binghamton-Johnson City Joint Sewage Treatment Plant (BJCJSTP).
- Located in Vestal, New York
- Medium wastewater utility; serves 90,000 customers
- Climate-related concerns include:
 - Flooding from storm events



Module 1: Climate Awareness

- Go to: <https://creat.epa.gov/creat>
- Log in using your WAA account
- Click on 'Get Started'
- Click on 'Build New Analysis'
- Name the analysis – If you are using the generic username, add your initials to the file name
- For 'Is this a streamlined analysis?', leave default answer of 'No' selected
- Click 'Save'

Module 1: Climate Awareness

- Complete Module 1 in CREAT using the handout provided
 - Enter utility information
 - Select current concerns

CREAT Risk Assessment Recap

- What type of utility is BJC?
 - Serves 90,000 people
 - Publicly owned
 - Wastewater Utility
- What are we currently concerned about?
 - Natural Disasters – flooding from heavy rain events
 - Interdependent Sector Reliability – power outages
- What assets are we concerned about?
 - Wastewater Treatment Plant

Next Step

- Identify how our current concerns could change in the future

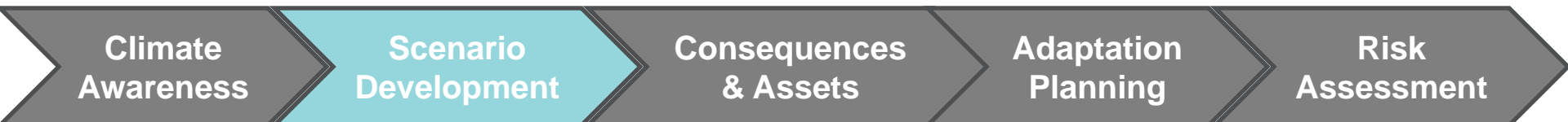


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CREAT Training Module 2: Scenario Development

Amy Posner, CSRA

Step 2 in the Risk Assessment Process



What have we done so far?

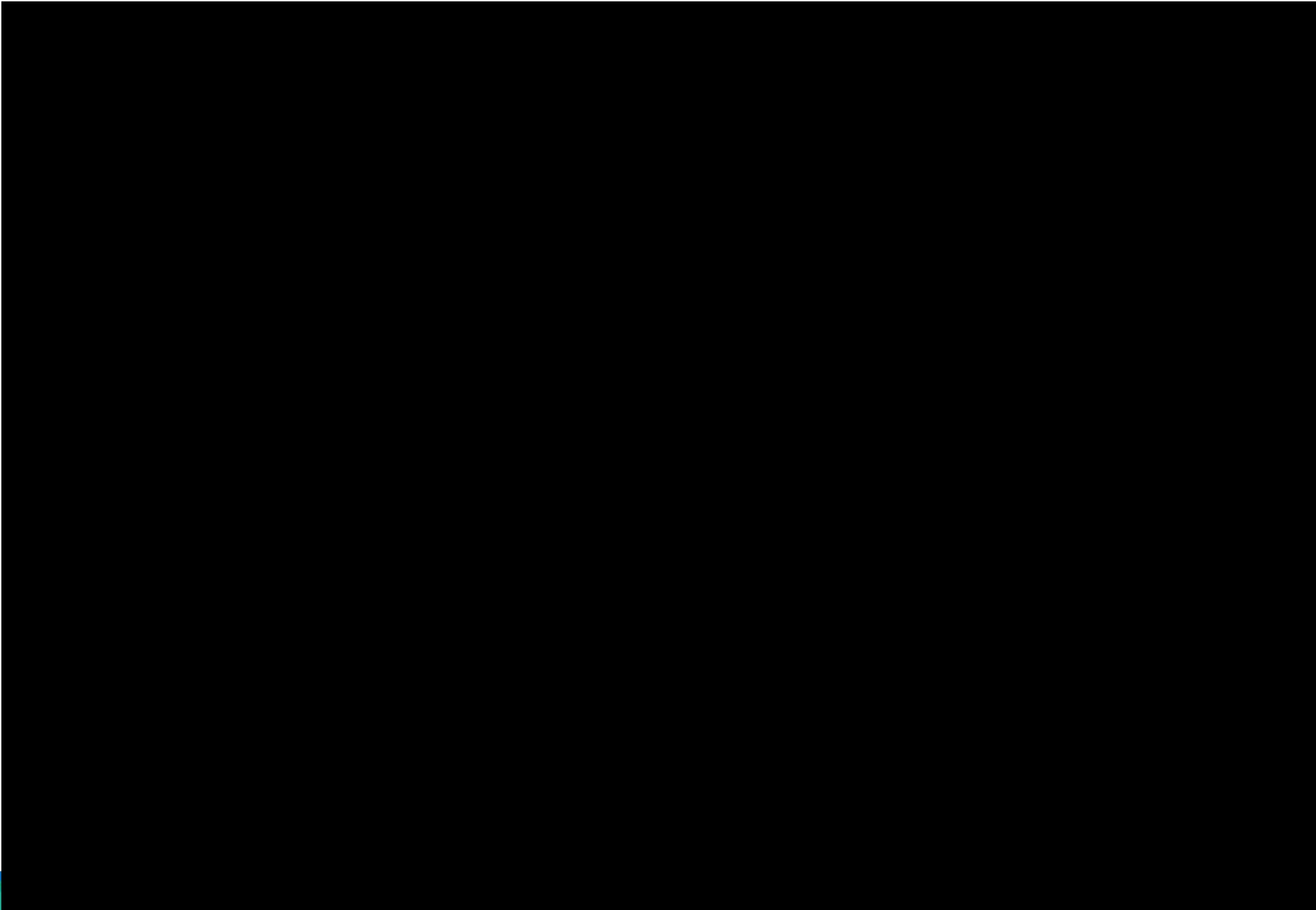
- Reviewed climate impacts
- Identified our current concerns

This module prompts you to think critically about the challenges your utility may face under future climate conditions and allows you to build scenarios to use in your assessments

Module 2: Scenario Development

Goal: Develop scenarios of potential future climate conditions for assessing impacts through time

Scenario Development Module Video



What is a scenario?

- In CREAT, scenarios are defined as projected changes in climate with respect to average conditions (temperature and precipitation), extreme events (intense precipitation and extreme heat), and sea level rise (for coastal locations)
- Scenarios can represent a range of potential climate conditions based on historical records, climate models or other data.



Baseline Scenario

- Historical climate conditions for a given location
- Use this scenario to compare how threats behave now and how they could change in the future

What could the future be like?

Projected Scenarios – Define projected scenarios to consider a range of potential conditions



How would threats change if the future was hotter and drier?



Or if the future was wetter than it is now?

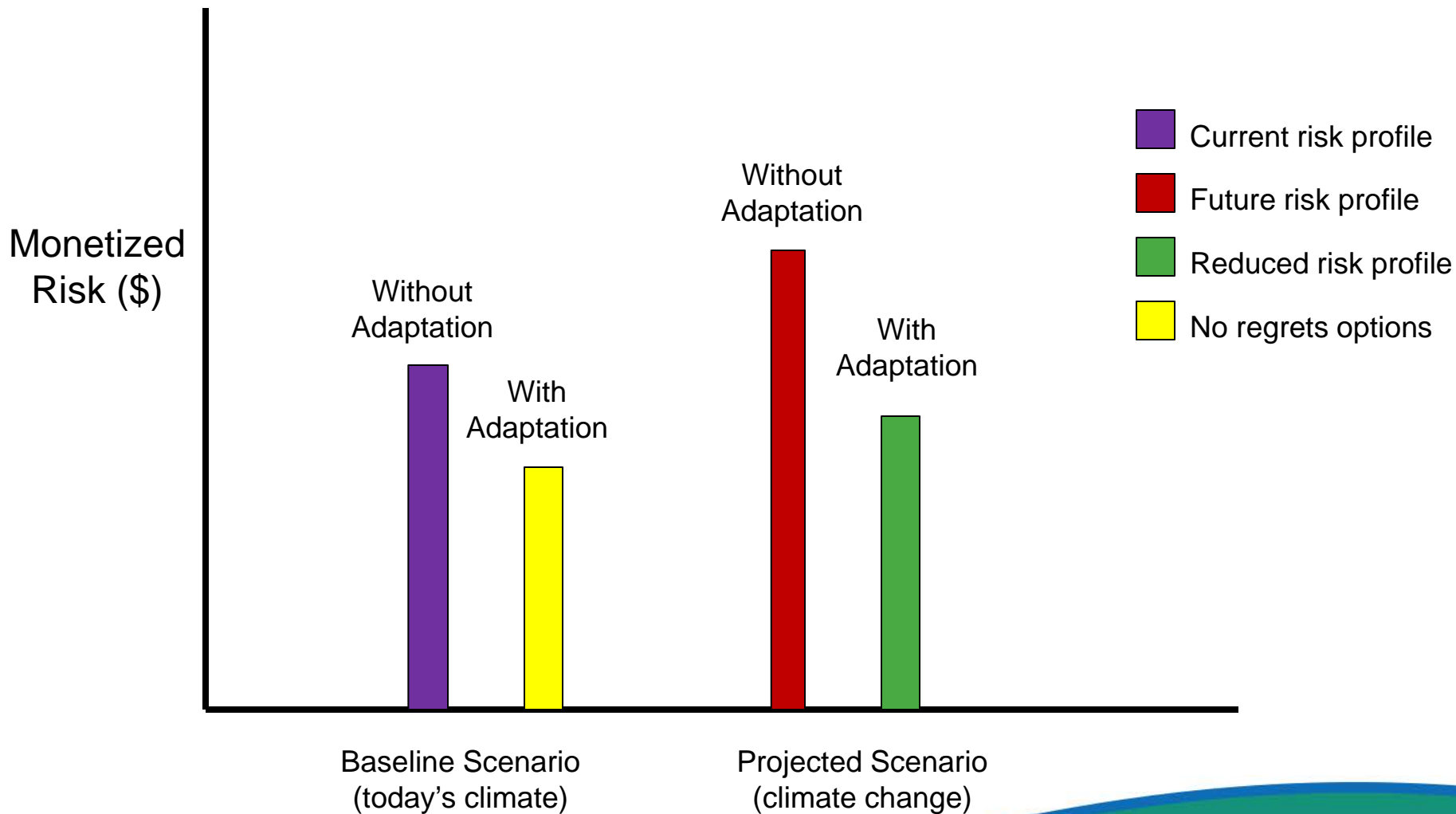


What would moderate changes in temperature and precipitation look like?

Threat Definition

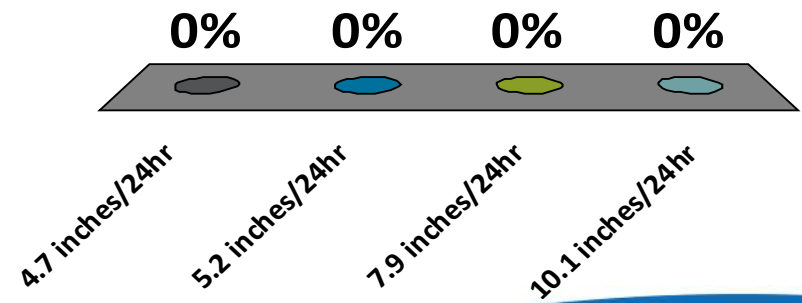
- Define threats to capture the impacts of future climate conditions
- Consider how past events could occur **more frequently** or result in **increased damage or challenges** to your utility's assets and operations
 - **Drought:** length of time in a specific drought stage, annual or seasonal rainfall, reservoir levels, stream flow
 - **Floods:** utility equipment that will be flooded/damaged, expected river levels
 - **Wildfire:** area burned, duration of impacts to water supply

CREAT in a Bar Graph - Revisited



The current 100-year storm event produces approximately 4.49 inches in a 24-hour period. What could be the new amount of rain in a 24-hour period for a 100-year event in the Vestal area by 2060?

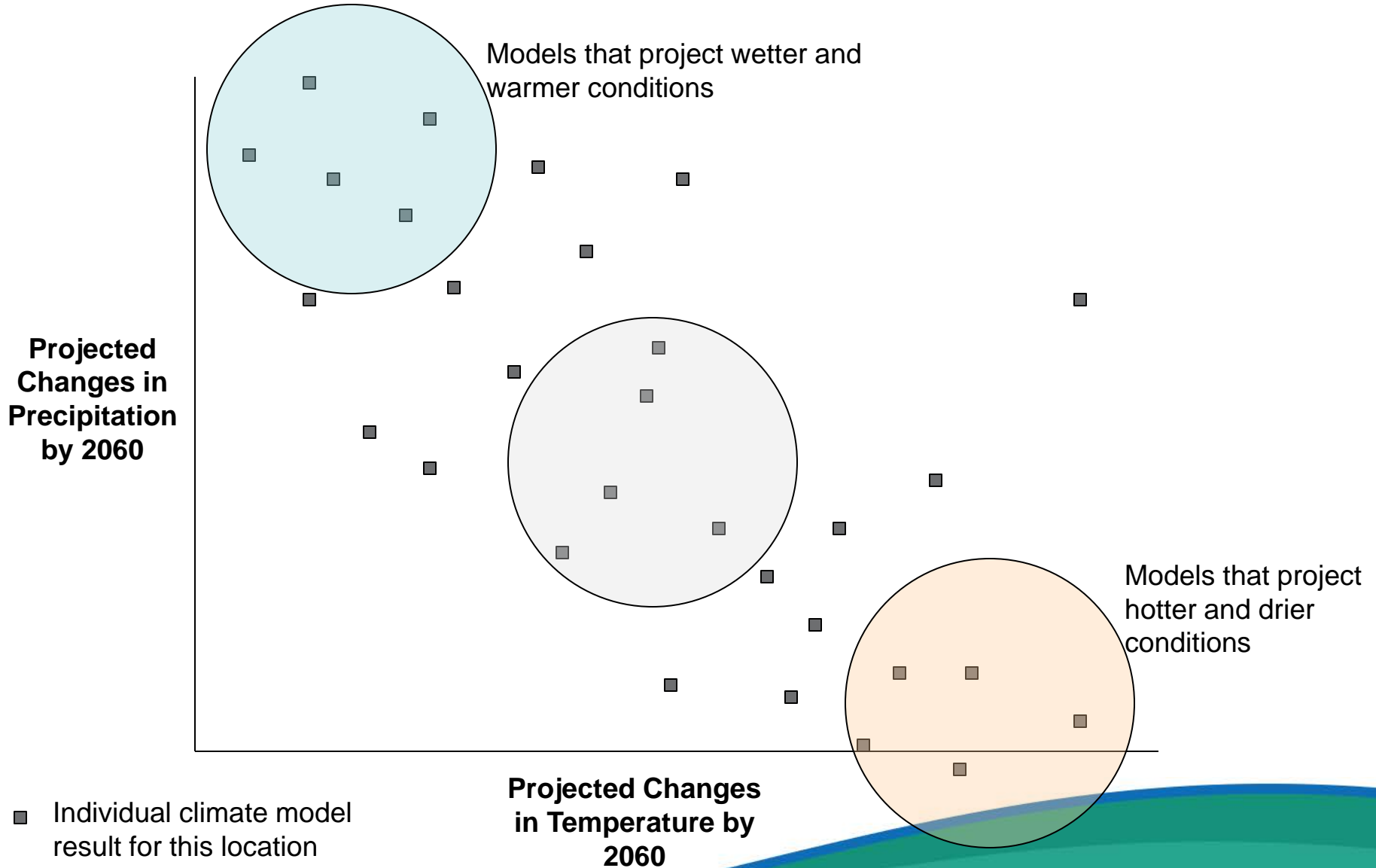
1. 4.7 inches/24hr
2. 5.2 inches/24hr
3. 7.9 inches/24hr
4. 10.1 inches/24hr



Module 2: Scenario Development

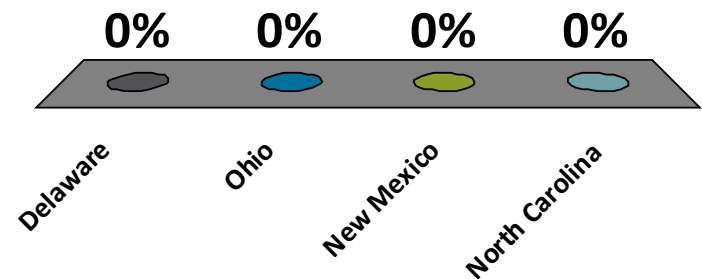
- Complete Module 2 in CREAT
 - Review historical and projected climate data
 - Build scenarios of future conditions
 - Identify and define threats

CREAT-Provided Projected Scenarios



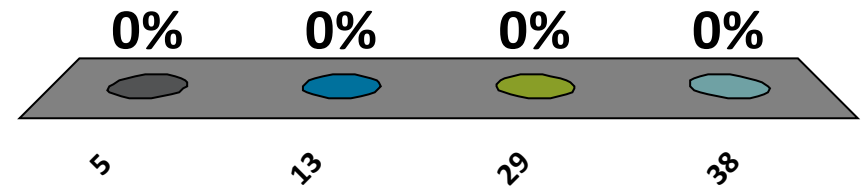
By 2060, Vestal would have an annual average temperature of 50°F, which would be close to which state's current annual average temperature?

1. Delaware
2. Ohio
3. New Mexico
4. North Carolina



How many climate models does CREAT use to provide climate scenarios?

- 1. 5
- 2. 13
- 3. 29
- 4. 38



CREAT Risk Assessment Recap

- What threat are we focusing on for this assessment?
 - Flooding from heavy rainfall events
- How could this threat change in the future?
 - 100-year storm event could become more intense
 - More frequent and more intense rain events
- What does this mean for our critical assets?
 - Inundation of BJCJSTP
 - More frequent and longer term power outages

Next Step

- Identify the assets that are most vulnerable to impacts and the consequences the utility would experience from this threat

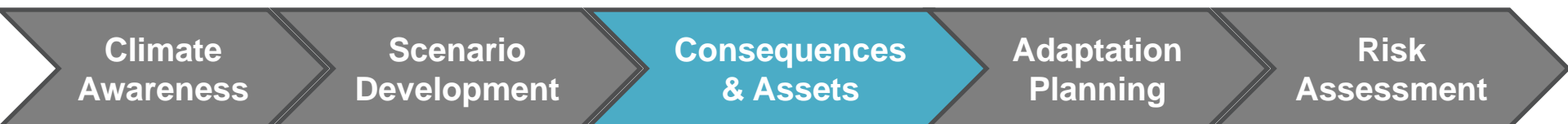


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CREAT Training: Consequences & Assets Module

Amy Posner, CSRA

Step 3 in the Risk Assessment Process



So far we have identified:

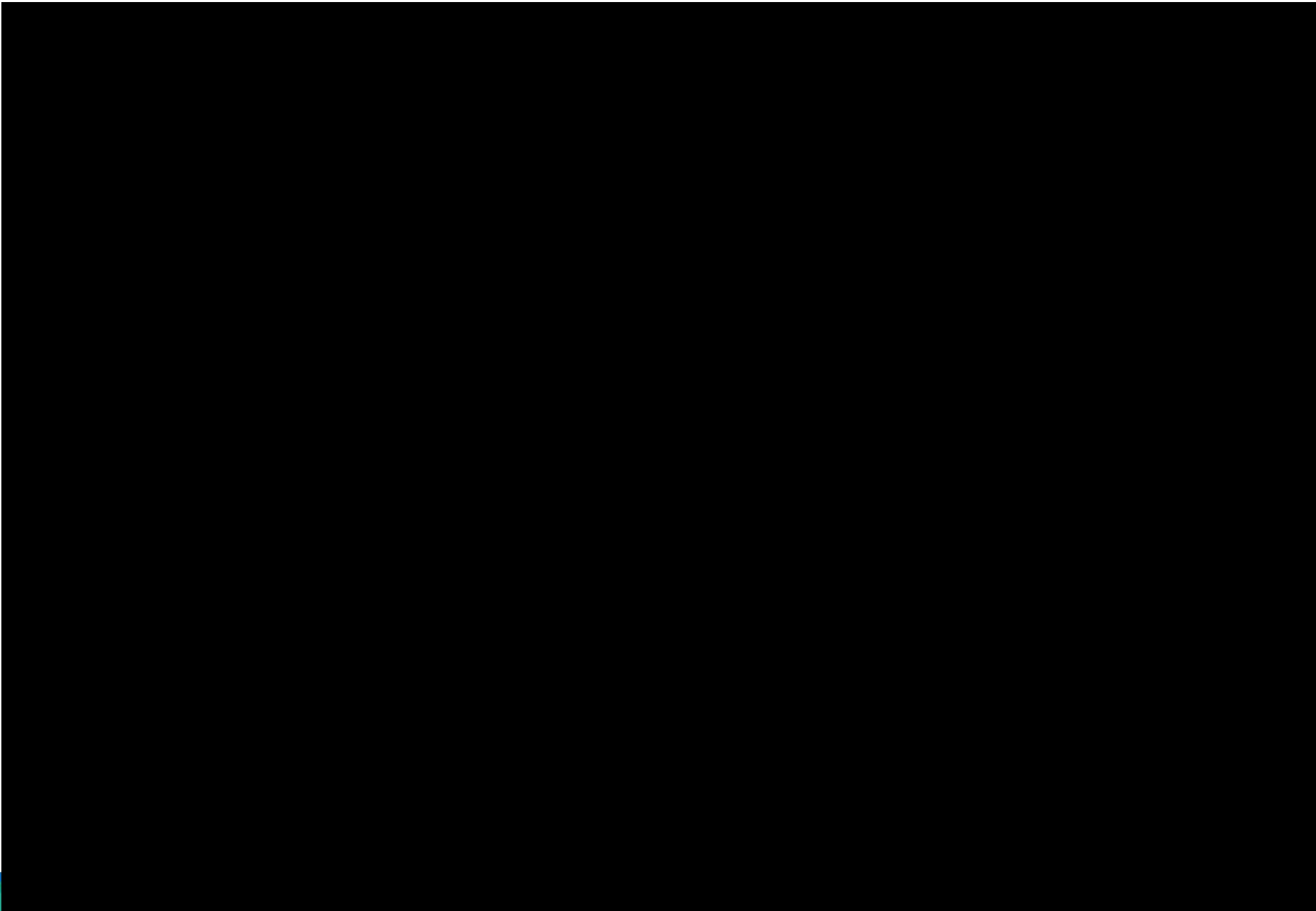
- Impacts from future climate conditions
- Current utility concerns
- Threat of concern
- Scenarios that outline current and future climate conditions
- How the threat might change over time

This module gives you the opportunity to consider the different types of consequences that may result from your threats and to identify priority assets for your assessment

Module 3: Consequences & Assets

Goal: Review CREAT's scorecard for use during your risk assessment and catalog assets and their value to the utility

Consequences & Assets Module Video



Consequence Categories

- Default categories are meant to capture the full range of potential consequences your utility could experience from a threat
- CREAT Economic Consequence Categories
 - Utility Business
 - Utility Equipment
 - Source/Receiving Water
 - Environmental Impacts
- Default \$ values for monetized risk are available for 4 levels: Low, Medium, High, Very High
- Option to consider Public Health consequences
 - Value of Statistical Life
 - Value of Statistical Injury

Economic Consequences Matrix

Monetary range for each level of each consequence category are based on:

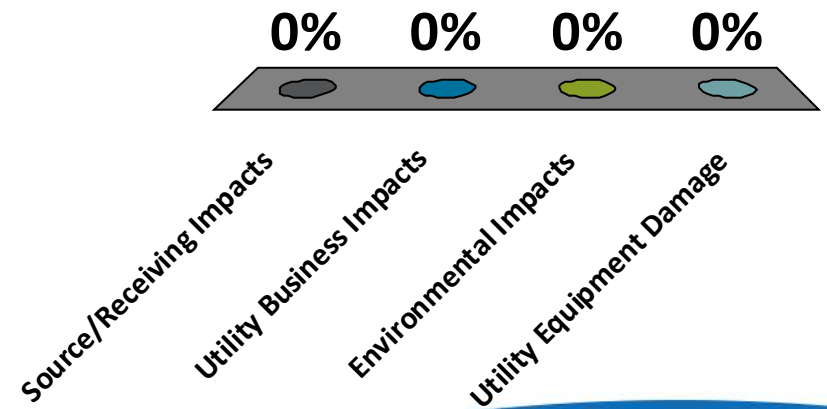
- Utility Profile
 - System type
 - Utility size
 - Financial condition
- Benchmarking data
 - EPA's Community Water System Survey (EPA 2009)
 - American Water Works Association Benchmarking Performance Indicators for Water and Wastewater Utilities (AWWA 2015)

Module 3: Consequences & Assets

- Complete Module 3 in CREAT
 - Review economic and public health consequences
 - Select critical assets

For the BJCJSTP example assessment, which economic consequence category had the highest maximum monetary consequence level?

1. Source/Receiving Impacts
2. Utility Business Impacts
3. Environmental Impacts
4. Utility Equipment Damage



CREAT Risk Assessment Recap

- What types of consequences could we face if our threat occurs?
 - Damage to key infrastructure
 - Water quality impacts
- Which asset(s) are we most concerned about and why?
 - BJCJSTP along the Susquehanna River
 - Increases in temperatures during the winter could mean precipitation falling as rain instead of snow. This could lead to future cumulative events that could exacerbate river levels and cause additional flooding at the plant
 - More intense storms could lead to more frequent and longer power outages

Next Step

- Identify what types of strategies we have in place that protect our asset and what other strategies we could implement to provide more protection

How do utilities define assets for inclusion in their assessment?

- Define assets at the level appropriate for analysis
 - Helpful to prioritize assets that are mission critical for analysis
 - Most utilities have known thresholds for specific portions of their system
 - Often helpful to keep assets at a higher level, only drill down if it will be helpful in terms of either isolating consequences or planning adaptation
- Upstream versus downstream impacts
 - If water source is far away from main facilities, may want to consider climate impacts for that location
 - Snowpack for coastal utilities whose reservoirs are fed by mountain runoff
 - Upstream wildfire affecting water quality
- Entire WWTP versus single pump station
 - Pump stations at lower elevations may be particularly vulnerable to flooding
 - WWTP may be appropriate level of analysis if threat results in electrical damage affecting the entire plant

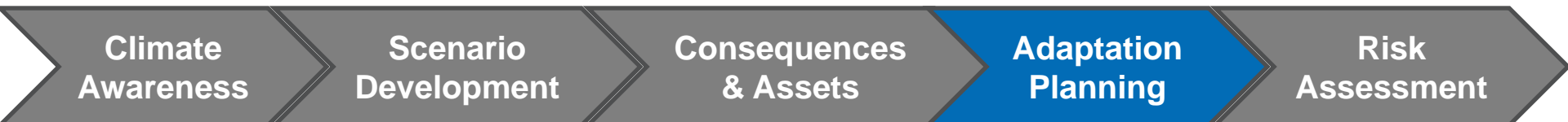


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CREAT Training Module 4: Adaptation Planning Part 1

Alfredo Lagos, CSRA

Step 4 in the Risk Assessment Process



So far, we have identified:

- Our threat
- How that threat could change through time
- The types of consequences if the threat were to occur
- Which assets are most at risk to the threat

This module allows you to document anything you are currently doing or would consider doing to increase resilience to threats and to organize these options into plans

Module 4: Adaptation Planning, Part 1

Goal: Document existing and potential adaptation strategies for protecting assets

Module 4: Adaptation Planning, Part 1

- Begin Module 4 in CREAT
 - Identify existing adaptive measures that increase resilience



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Identifying Potential Adaptive Measures Small Group Discussion

Alfredo Lagos, CSRA

Small Group Instructions

- Group Charge
 - Think about potential adaptive measures that could be implemented to further protect our utility's critical assets
 - Assess the strengths and weaknesses of the provided menu of potential adaptive measures
 - Identify and rank your top 5 potential adaptive measures
 - Draw on your own experience and think about constraints you would consider in making planning decisions (e.g., financial, political, regulatory)
 - Identify any questions about adaptive measures or CREAT
- Self-facilitated Process
 - Assign a note-taker to capture key ideas
 - Identify someone to report-out on your discussion, covering:
 - Priority adaptive measures identified by your group
 - Rationale for your priorities
 - Questions about CREAT



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Prioritization of Potential Adaptive Measures

Small Group Reports

- Priority adaptive measures identified by your group
- Rationale for your priorities
- Questions about CREAT
- Other key takeaways, questions or feedback

*Which adaptive measures would you build into
an adaptation plan?*

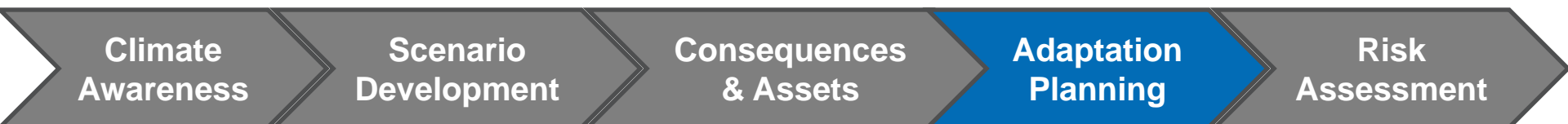


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CREAT Training Module 4: Adaptation Planning Part 2

Alfredo Lagos, CSRA

Step 4 in the Risk Assessment Process



This module allows you to document measures you currently have in place or would consider implementing in the future to increase resilience and to organize these measures into plans

Module 4: Adaptation Planning, Part 2

Goal: Document potential adaptation plans for protecting assets

How do utilities typically design adaptation plans?

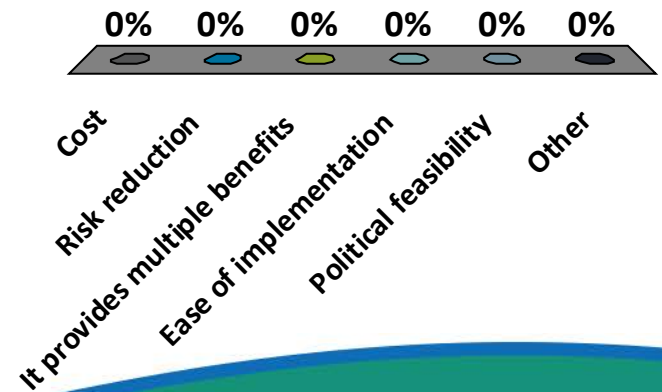
- There is no one size fits all, but here are some examples of how we have seen other utilities approach this challenge:
 - Develop a ‘no-regrets’ plan (one with benefits aside from resilience to threats)
 - Develop plans based on available funding or that complement other utility priorities (for example, sustainability, energy savings)
 - Develop plans to be implemented over time (short term measures first, then longer term)
 - Develop different plans based on certain trigger events or thresholds (reservoir levels)

Module 4: Adaptation Planning, Part 2

- Complete Module 4 in CREAT
 - Identify potential adaptive measures that increase resilience
 - Build adaptation plans

What is the most important consideration for your organization when considering measures to implement?

1. Cost
2. Risk reduction
3. It provides multiple benefits
4. Ease of implementation
5. Political feasibility
6. Other



CREAT Risk Assessment Recap

- What are we most worried about in the future?
 - More frequent and intense flooding events could cause additional flooding at the BJCJSTP
 - More frequent and longer power outages
- What types of things do we currently do to protect our assets from these impacts?
 - Weather forecast monitoring
- What are we thinking about doing in the future?
 - Build a flood wall
 - Raise electrical equipment and VFDs
 - Install back-up generators

Next Step

- Identify the potential benefits from implementing our adaptation plans

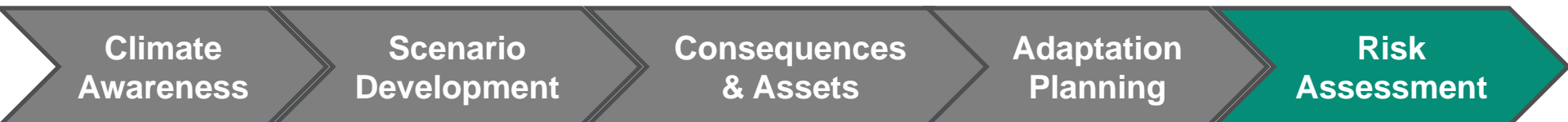


Resilience Planning and Adaptation Training for Water and Wastewater Utilities

CREAT Training Module 5: Risk Assessment

Amy Posner, CSRA

Step 5 in the Risk Assessment Process



So far, we have identified:

- Our threat
- How that threat can change through time
- The types of consequences if the threat were to occur
- Which assets are at risk to the threat
- Current and new strategies to protect these assets from the threat
- Plans of adaptation strategies that we could implement

This module guides you through the risk assessment process and provides monetized risk and plan costs as outputs

Module 5: Risk Assessment

Goal: Assess the capabilities and benefits of plans across your defined scenarios

Conducting assessments for individual asset/threat pairs is typically the most difficult step

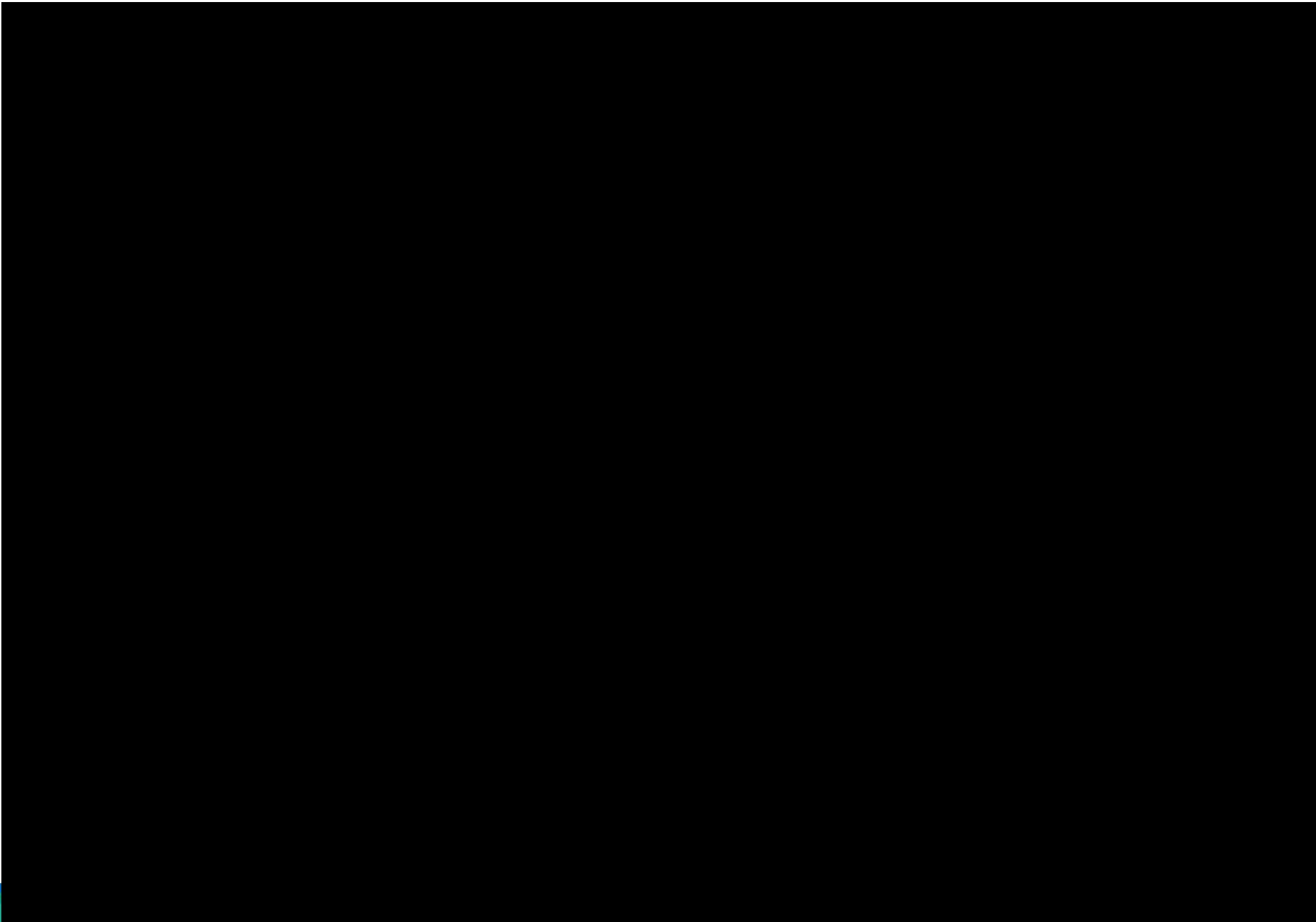
Asset-Threat Pairs

- Assess consequences from the threat occurring and impacting your asset
 - Select level of consequences (Low – Very High) for each category in the Economic Consequences Matrix
 - Consequences are summed across all categories
 - Assess consequences for each scenario and adaptation plan
- Assessment shows
 - Consequences the utility could experience with and without adaptation measures
 - Calculate benefits of implementing adaptation plans
 - Compare benefits to the cost of implementing the plan

Module 5: Risk Assessment

- Complete Module 5 in CREAT
 - Assess consequences for asset-threat pair
 - Review results

Risk Assessment Video



CREAT Risk Assessment Recap

Using the CREAT process, we have built a risk assessment identifying the following:

- Our climate threat
- How that threat can change through time
- The types of consequences if the threat were to occur
- Which assets were at risk to the threat
- Current and new strategies to protect the asset from that threat
- Plans of adaptation strategies that we could implement to provide further protection
- Benefits of implementing those adaptation plans compared to the cost of doing nothing
- How likelihood can inform adaptation decision making
- External benefits or impacts due to adaptation plan implementation that should be taken into consideration

What do we do now that we have completed our CREAT assessment?

- Communicate our results to decision-makers
- Identify additional information to refine our assessment
- Secure funding for adaptation implementation
- Share our findings with partners, customers and other stakeholders
- Add our adaptation case study to CRWU's [Adaptation Case Study and Information Exchange](#) map




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Funding Resilience and Adaptation

Khristopher Dodson, Syracuse University Environmental Finance Center

CREAT Training Wrap-up

- Complete a CREAT assessment for your utility or provide technical assistance for an organization in using CREAT
- Communicate opportunities for using CREAT with other utility personnel
- Provide staff training on CREAT and other CRWU resources
- Review funding handout and identify opportunities for building climate resilience

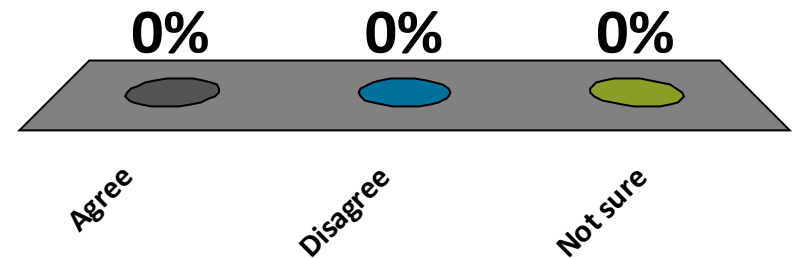


Resilience Planning and Adaptation Training for Water and Wastewater Utilities

Training Wrap-Up

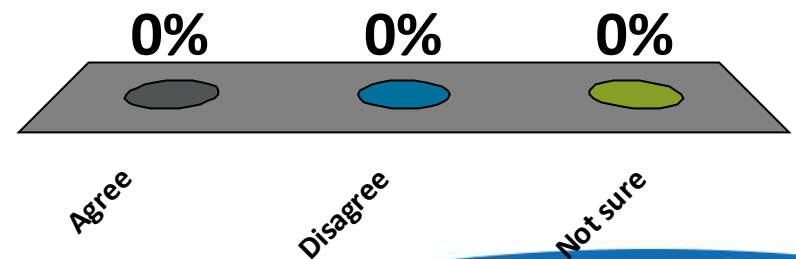
I will use CREAT at my organization to conduct a risk assessment.

1. Agree
2. Disagree
3. Not sure



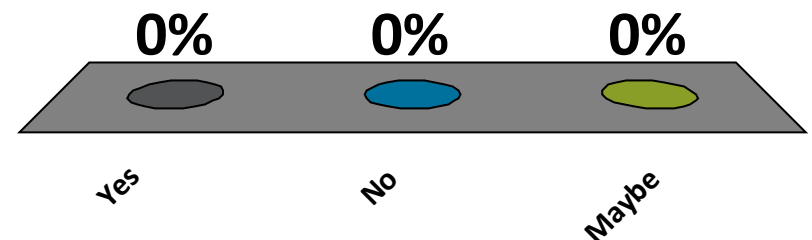
I will share the information I learned at this training with my colleagues and management.

1. Agree
2. Disagree
3. Not sure



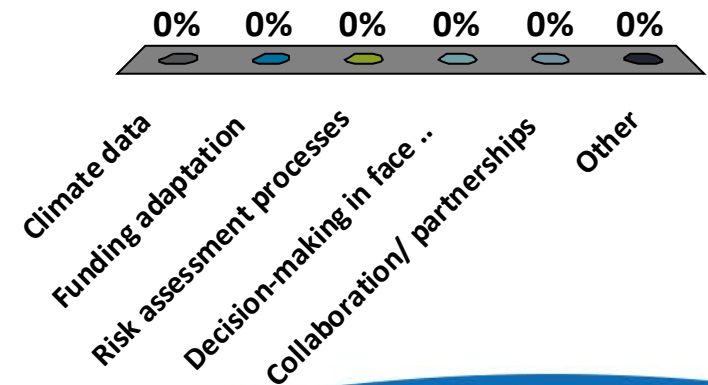
Would you like to participate in future webinars to learn more about CRWU resources or get additional help with your CREAT assessment?

1. Yes
2. No
3. Maybe



What topic would you like more information on in the future?

1. Climate data
2. Funding adaptation
3. Risk assessment processes
4. Decision-making in face of uncertainty
5. Collaboration/ partnerships
6. Other



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