Metro Water District Climate Utility Resiliency Study

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ATLANTA REGIONAL COMMISSION
regional impact + local relevance

Metropolitan North Georgia Water Planning District

Outline

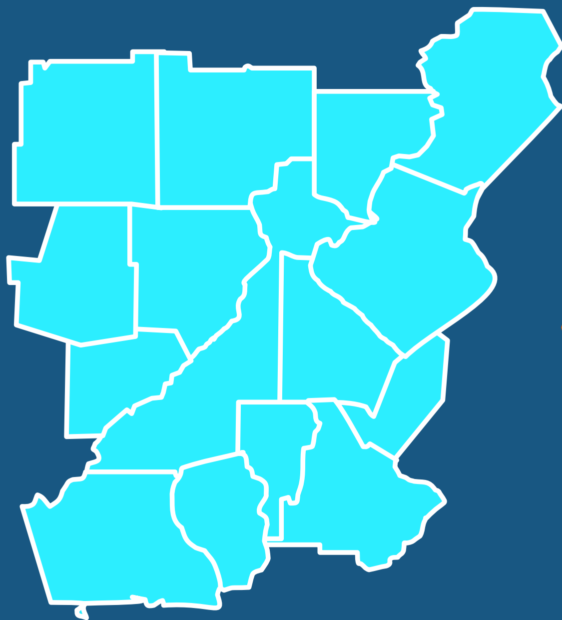
- Metro N. GA Water Planning District Overview
- Goals of Utility Climate Resiliency Study
- Potential Future Climate Scenarios
- Methodology and Findings for Vulnerability Analysis:
  - Water Demand Impacts
  - Water Supply Impacts
  - Water Quality Impacts
  - Watersheds: Flooding / Pollutant Loading
- Infrastructure Adaptation
- Summary

Regional Water Resources Plans

- ➤ Water Supply & Water Conservation Plan
- ➤ Wastewater Management Plan
- ➤ Watershed Management Plan

Regional Water Resources Plans

Metro Water District develops regional plans



Local governments responsible for implementing plans

Georgia EPD approves plans and enforces implementation via permits

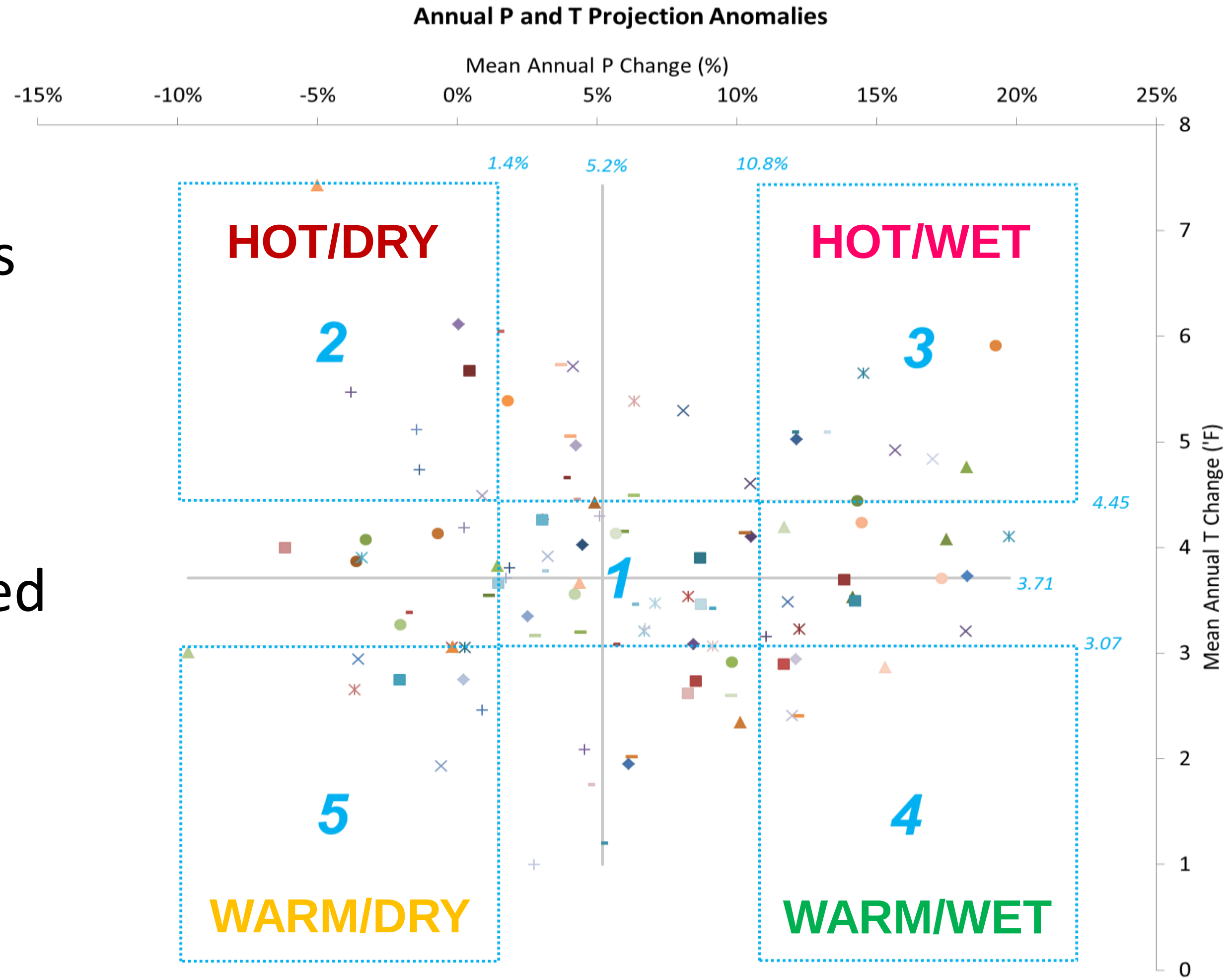
Goals of Utility Climate Resiliency Study

- Produce a plan for the District that can be used to guide future planning efforts
- Assess potential vulnerability of water resources and related infrastructure given potential climate conditions in the future:
  - **Not Predictive**: The purpose was **NOT** to predict future climate conditions or the likelihood that certain conditions could occur.
  - **Readiness:** The purpose **WAS** to identify potential climate conditions that, if they do occur, could create specific risks.

Representative Summary of Climate Scenarios

5 representative scenarios of possible future climate conditions based on GCMs

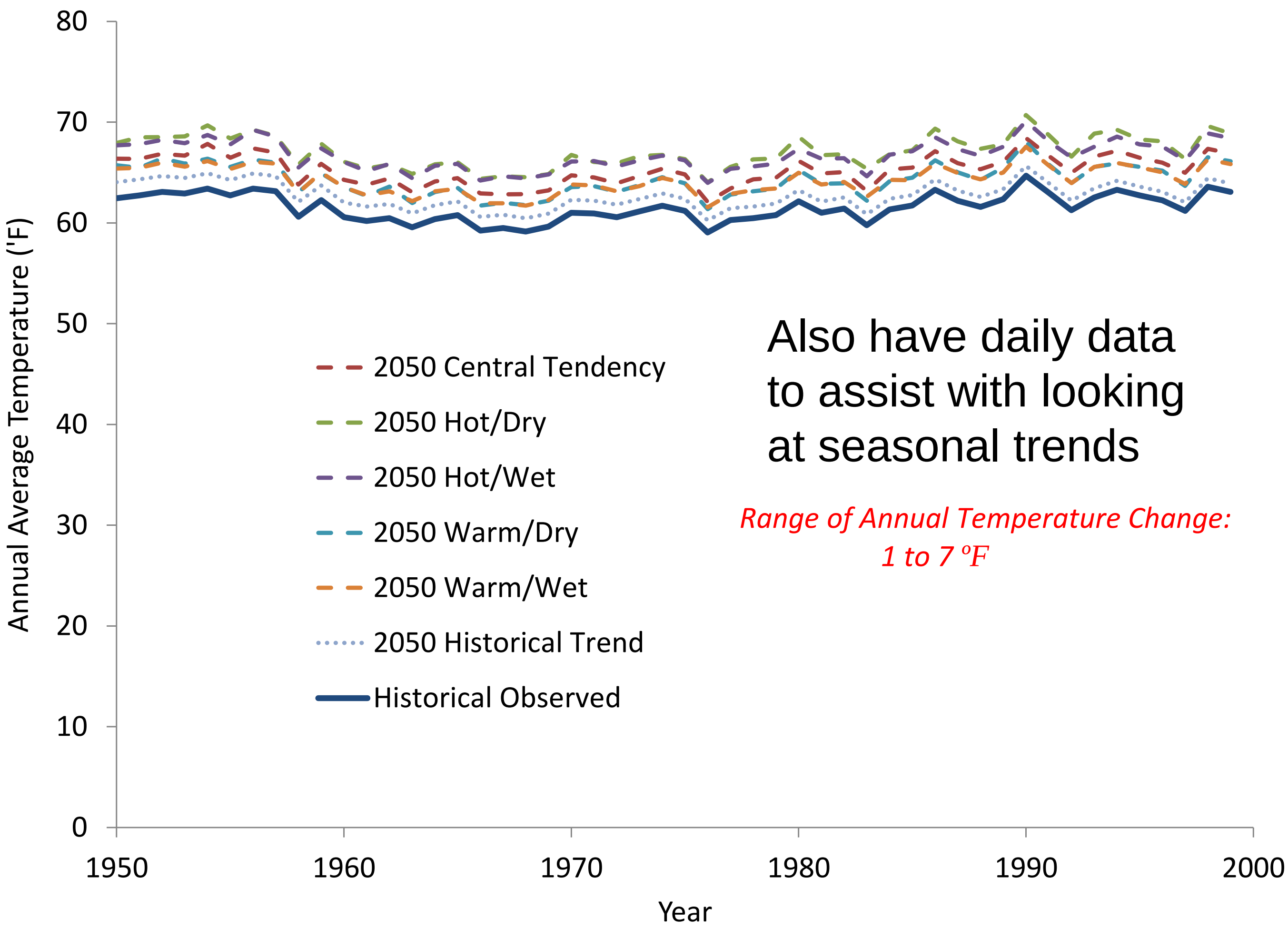
1 additional scenario developed by extending historic records through 2050.



Future Climate Scenarios: Methodology

- Climate Model Scenario Methodology: “Delta” method
  - Adjusting 50 year historical record (1950 – 1999) to reflect 2050 projections for each ensemble
  - Maintains observed climate patterns, change factors based on modeled vs. modeled relative changes (reduces bias)
  - End result is 5 sets of 50 year adjusted historical climate records

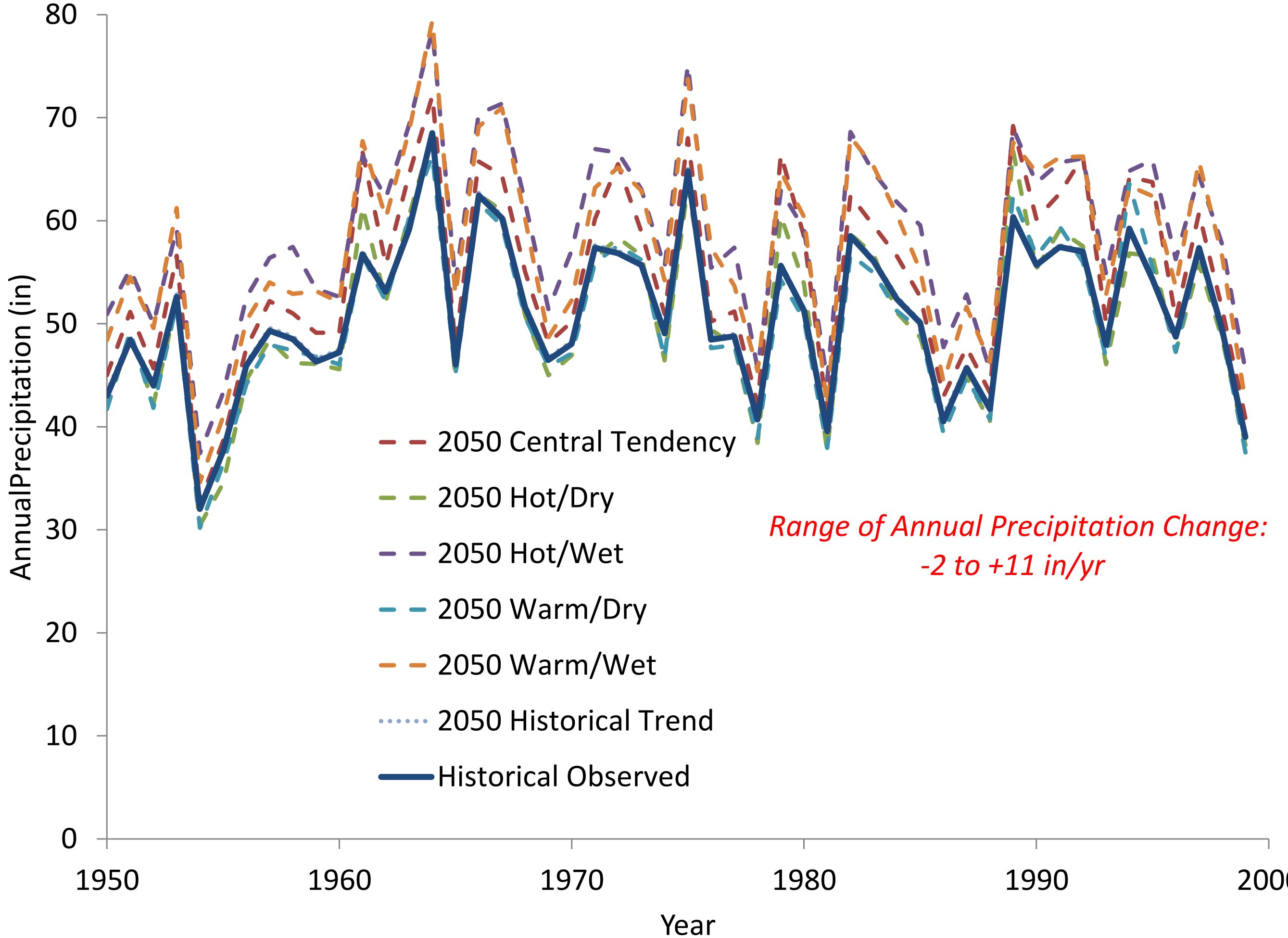
Future Climate Scenarios: Annual Temperature



Also have daily data to assist with looking at seasonal trends

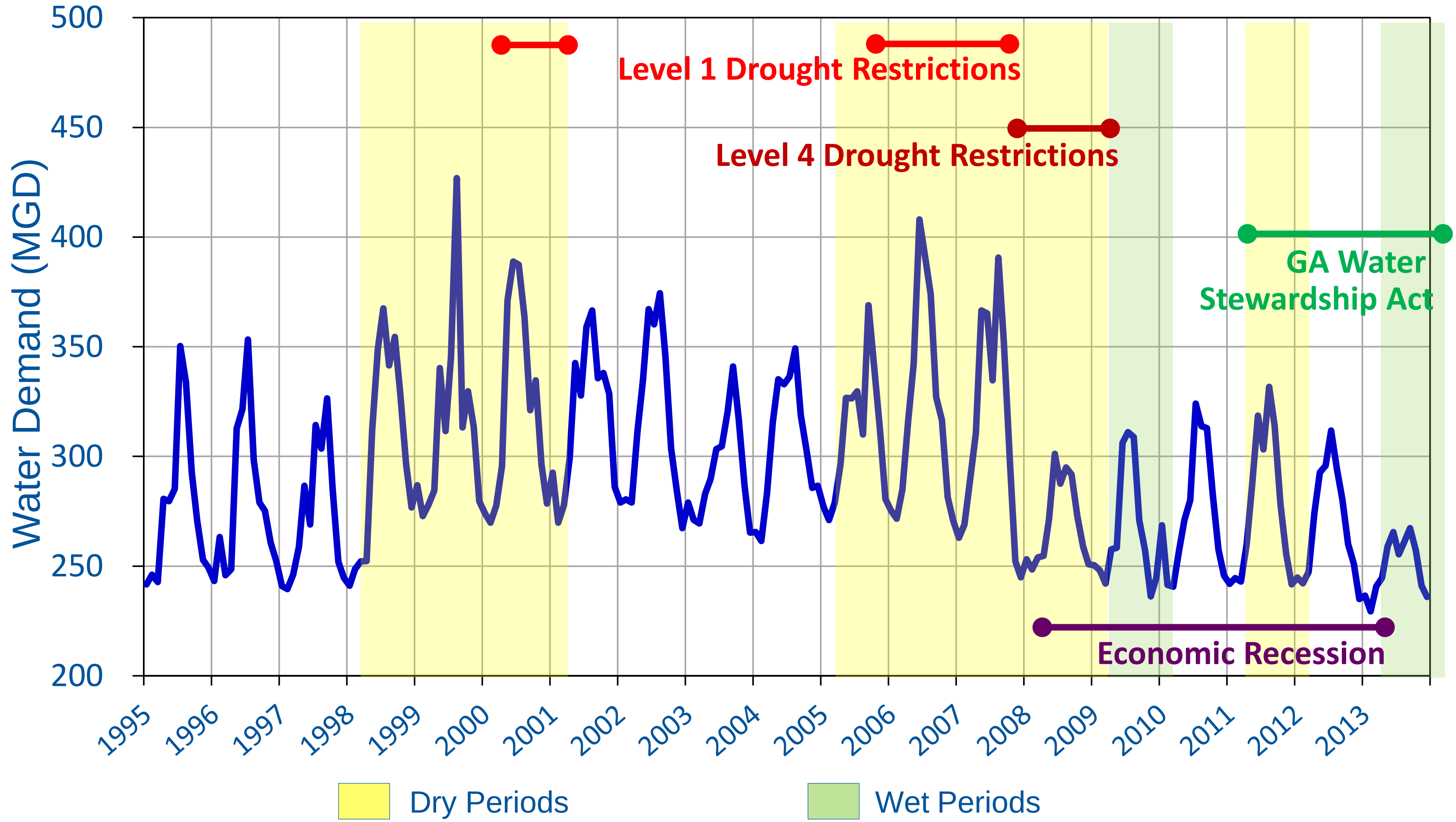
Range of Annual Temperature Change: 1 to 7 °F

Future Climate Scenarios: Annual Precipitation

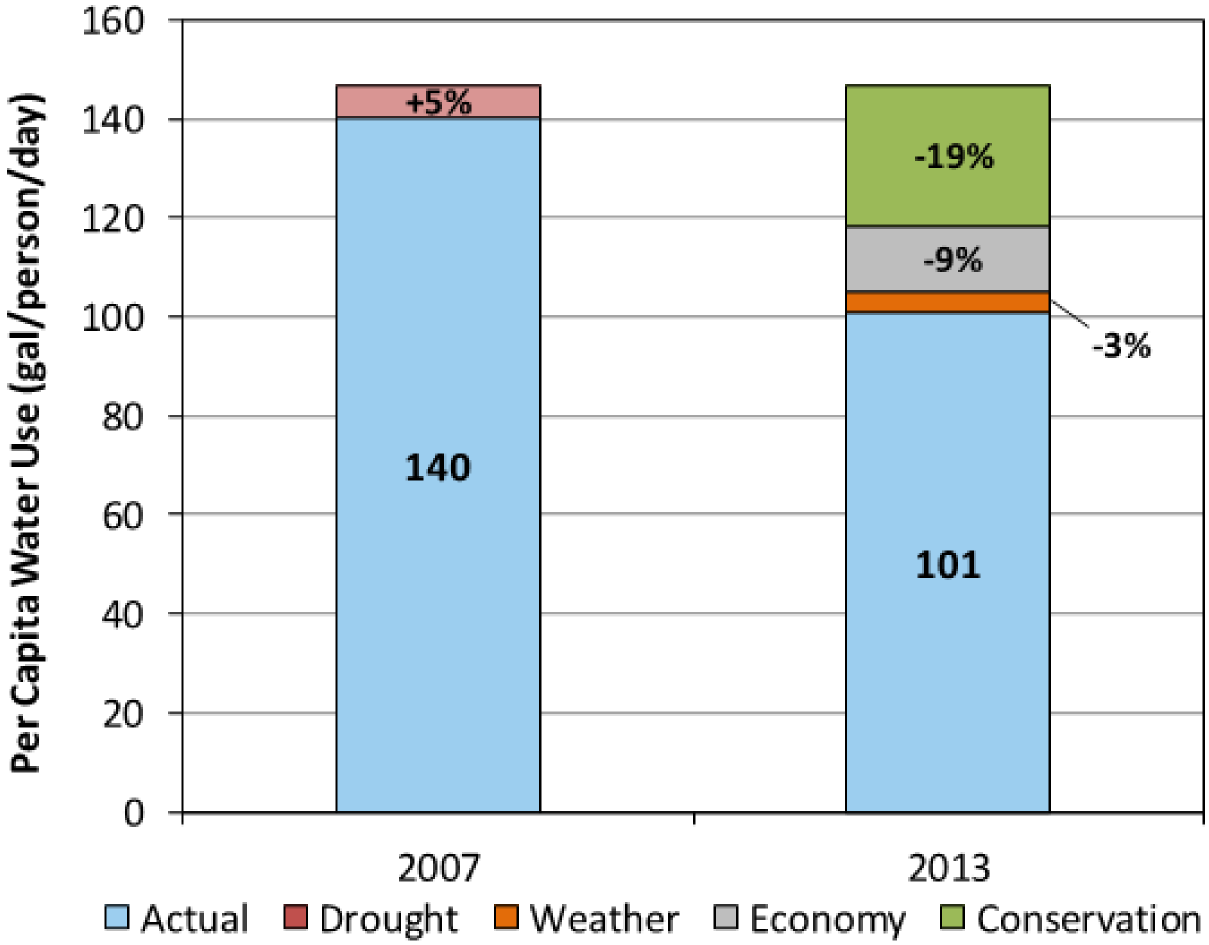


WATER DEMAND IMPACTS

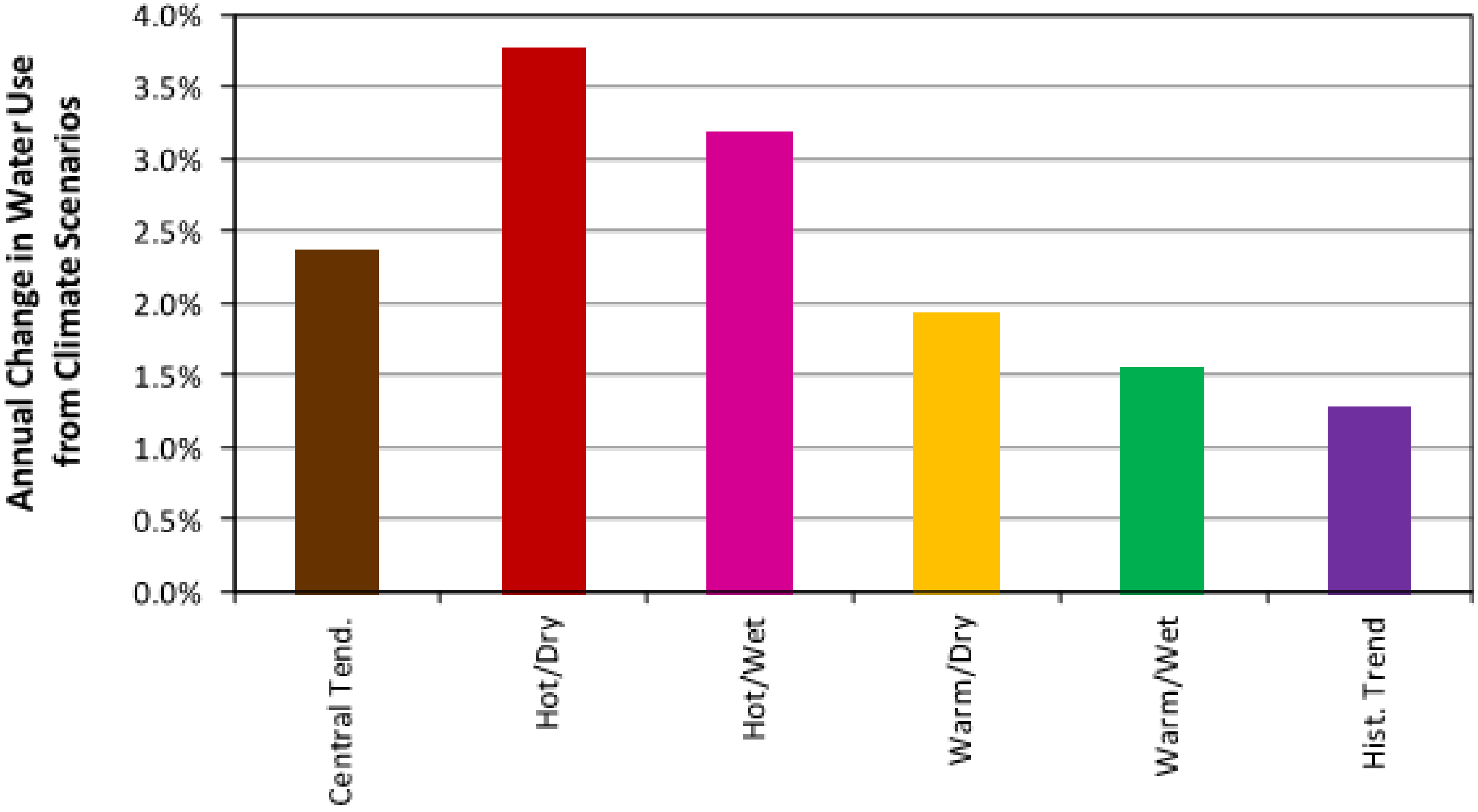
Analysis of Water Demands: DeKalb, Fulton and Gwinnett Counties as Proxy



Water Demand:
Sensitivity to Climate via Multivariate Regression



Potential Impacts of Climate Variability: Per Capita Water Use (by 2050)*



** Average increase, with all other factors unchanged.*

CDM Smith

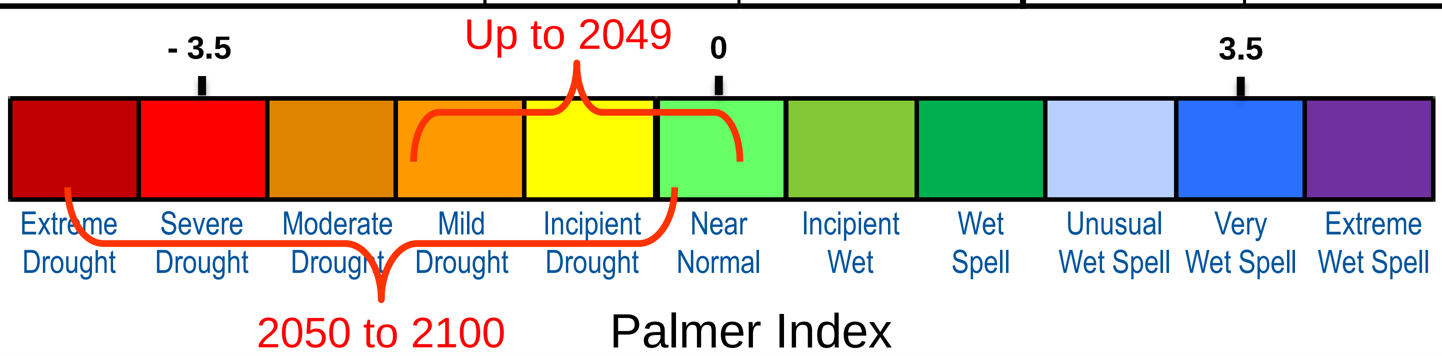
WATER SUPPLY IMPACTS

Future Climate Scenarios: Droughts

Key Message: Tendency toward increased drought conditions

Summary of Mann-Kendall Drought Analysis: Atlanta, 2000 - 2100

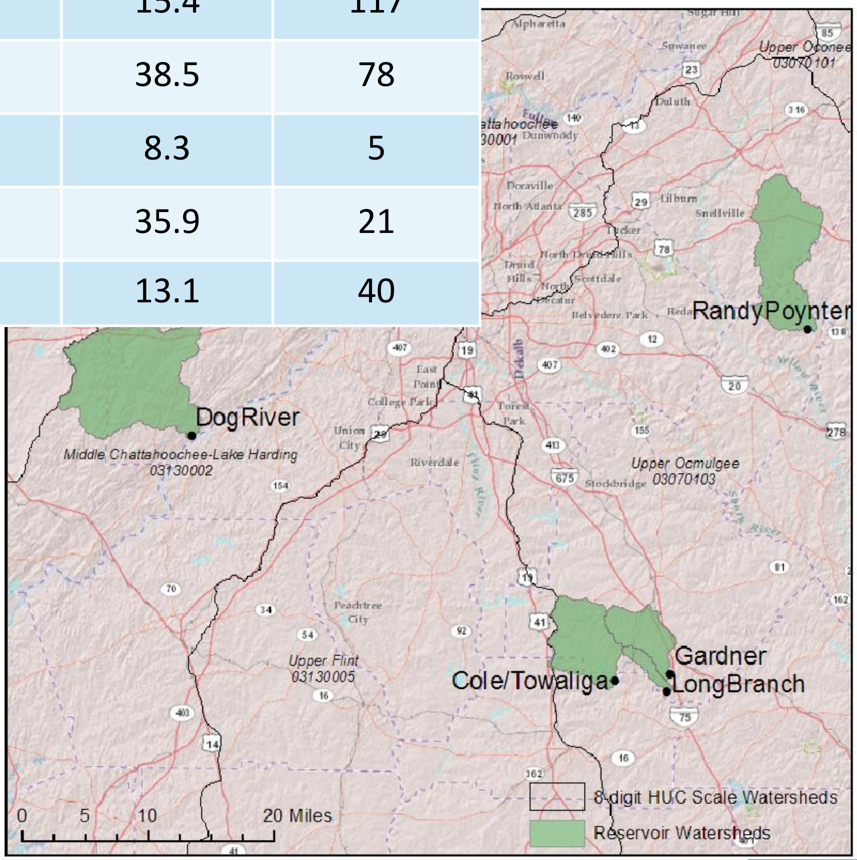
Projection	Avg PDSI	Avg Drought Condition	Avg PDSI	Avg Drought Condition
Historical Observed (1900 - 2014)	-0.20	near normal		
	2000 - 2049		***2050 - 2100***	
Central Tendency	-0.73	incipient dry	-1.72	mild drought
Hot/Dry	-1.81	mild drought	-4.49	extreme drought
Warm/Dry	-0.81	incipient dry	-1.34	mild drought
Hot/Wet	-0.10	near normal	-0.99	incipient dry
Warm/Wet	0.24	near normal	0.21	near normal



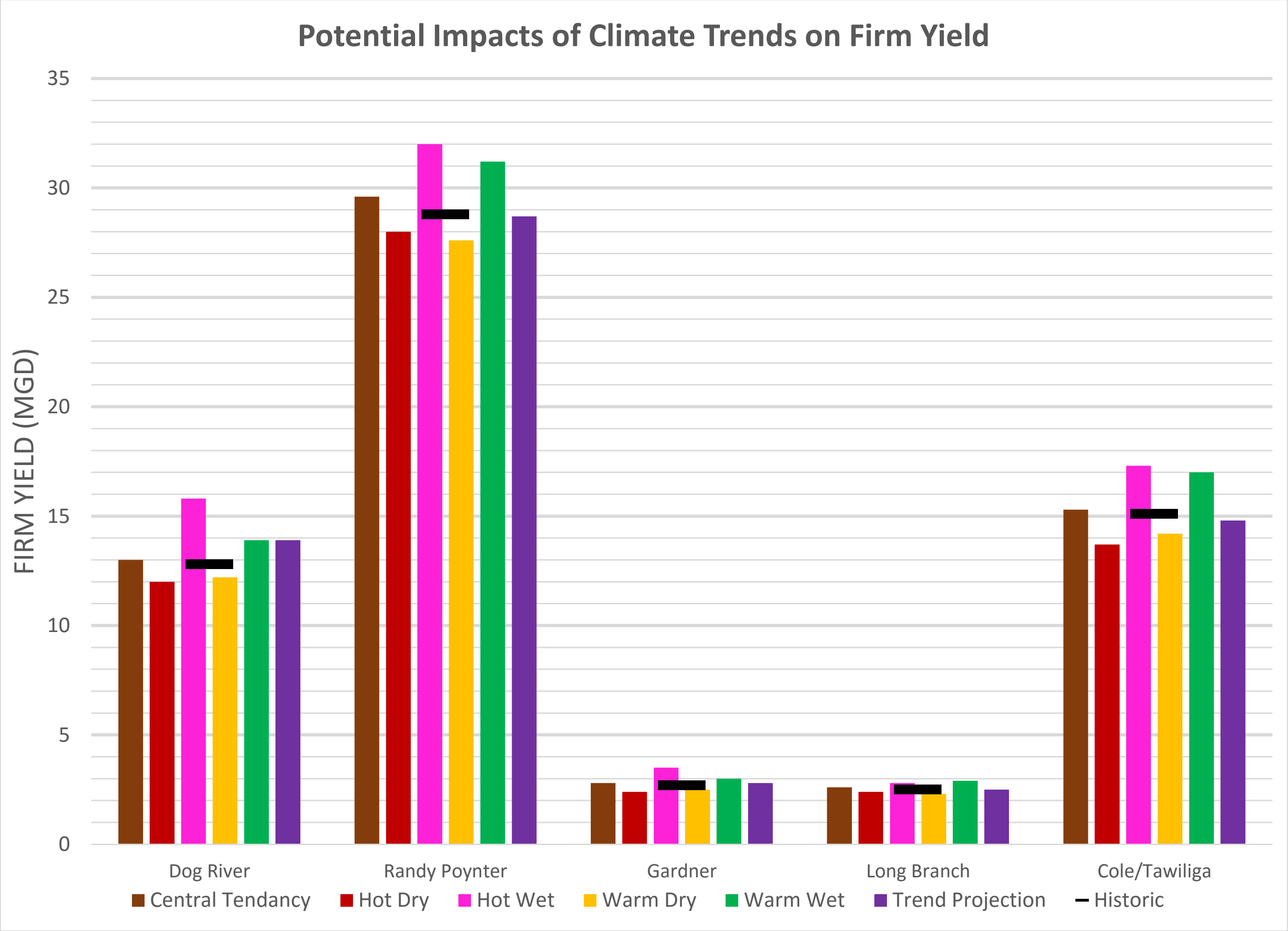
Methods to Evaluate: Water Supply Vulnerability

Reservoir	County	Storage Volume (BG)	Drainage Area (sq.mi.)	Percent watershed developed	Estimated Average Flow (cfs)
Dog River Reservoir	Douglas	1.9	78.3	15.4	117
Randy Poynter Reservoir	Rockdale	5.4	47.0	38.5	78
Long Branch Reservoir	Henry	1.5	4.3	8.3	5
Gardner Reservoir	Henry	0.7	16.9	35.9	21
Upper Towiliga Reservoir	Henry	6.0	29.4	13.1	40

- Estimate the potential impacts of future climate scenarios on Reservoir Firm Yield
- Use a range of physical/hydrologic features to examine specific indicators of risk
- Identify the types of climate trends that could create risk



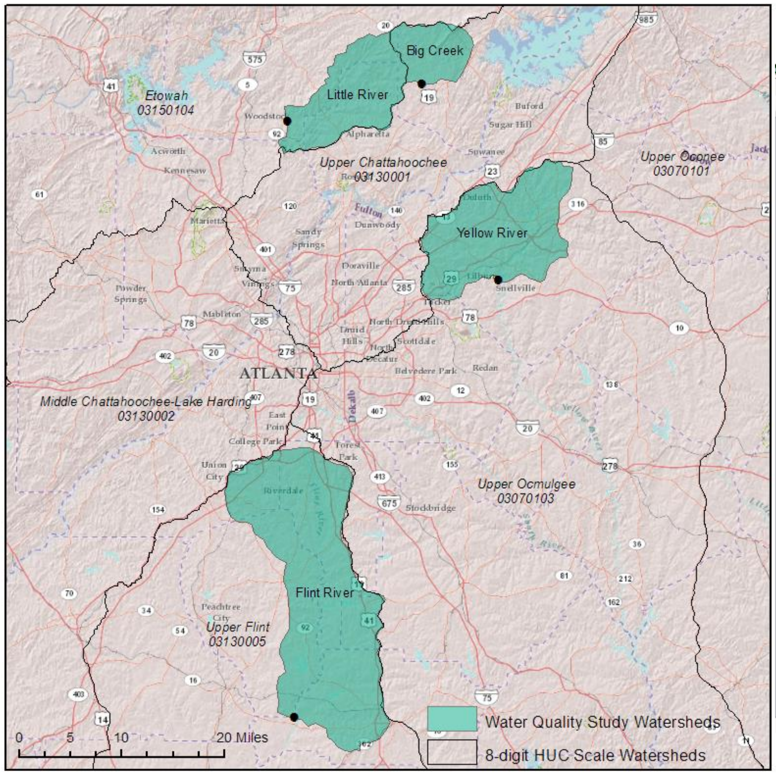
Relationship Between Precipitation and Yield



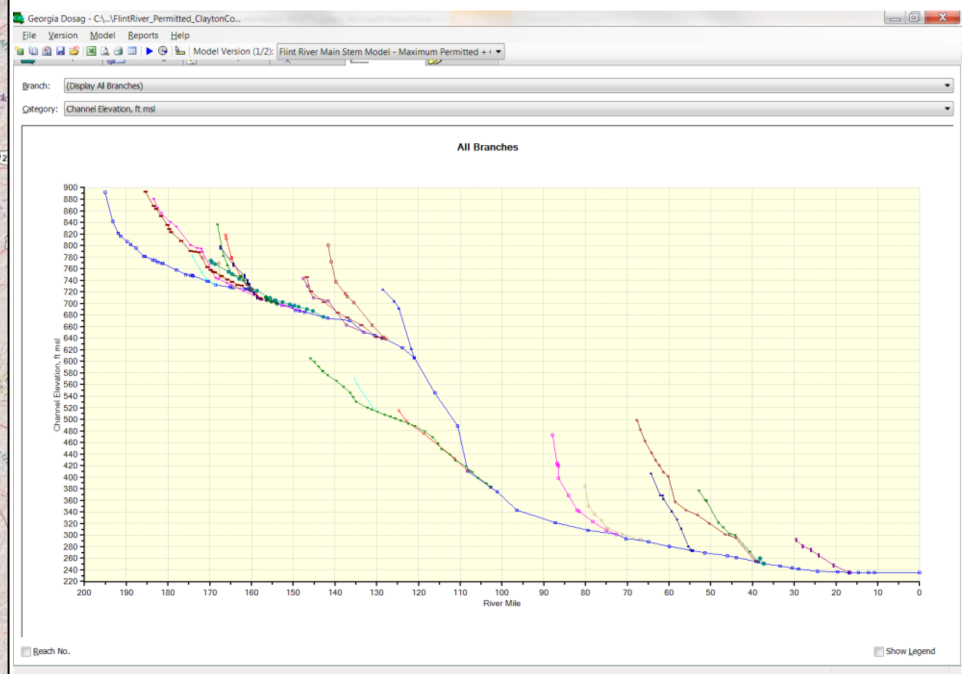
WATER QUALITY IMPACTS

Methods to Evaluate: Water Quality Vulnerability

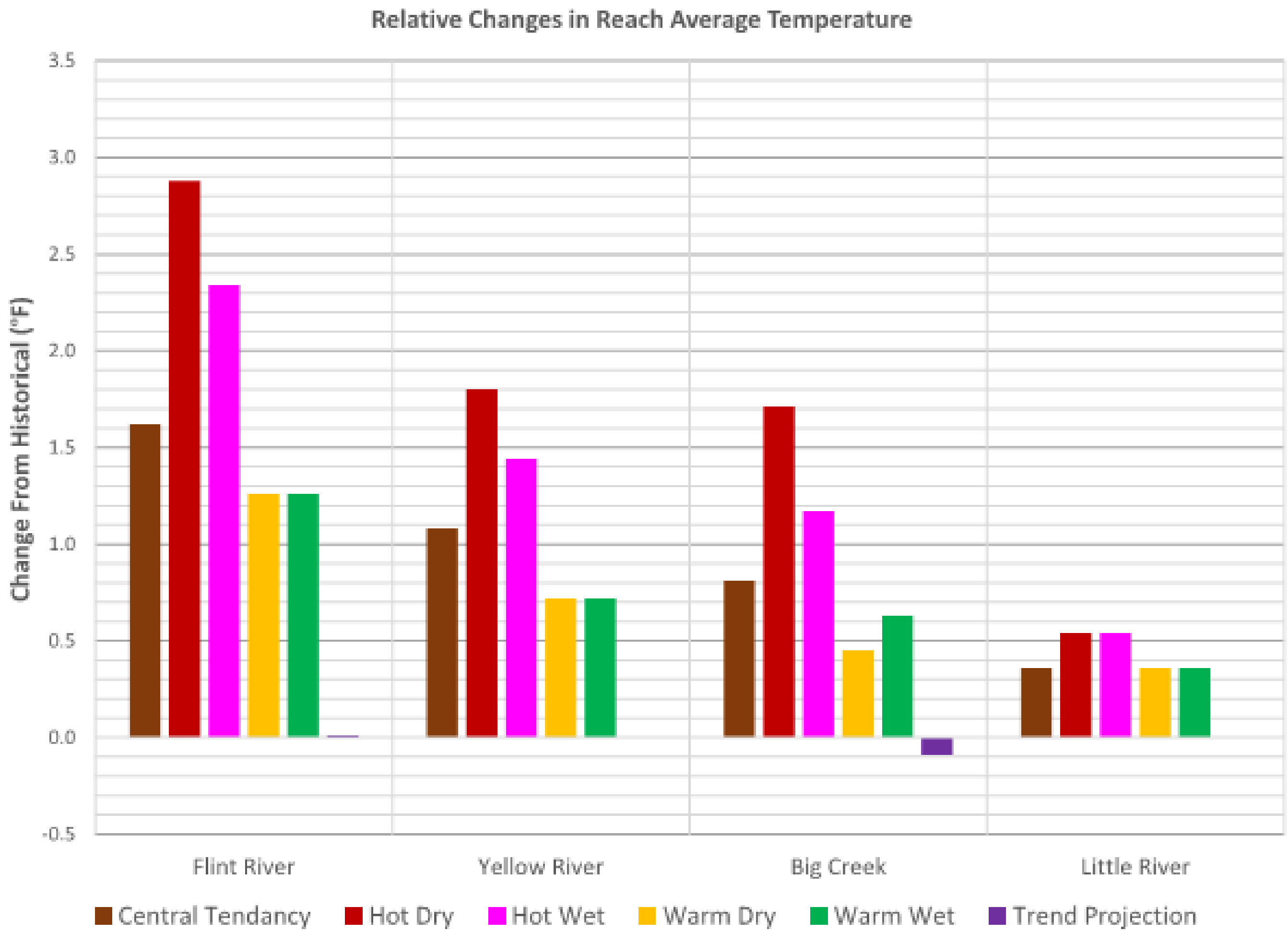
Select Watersheds



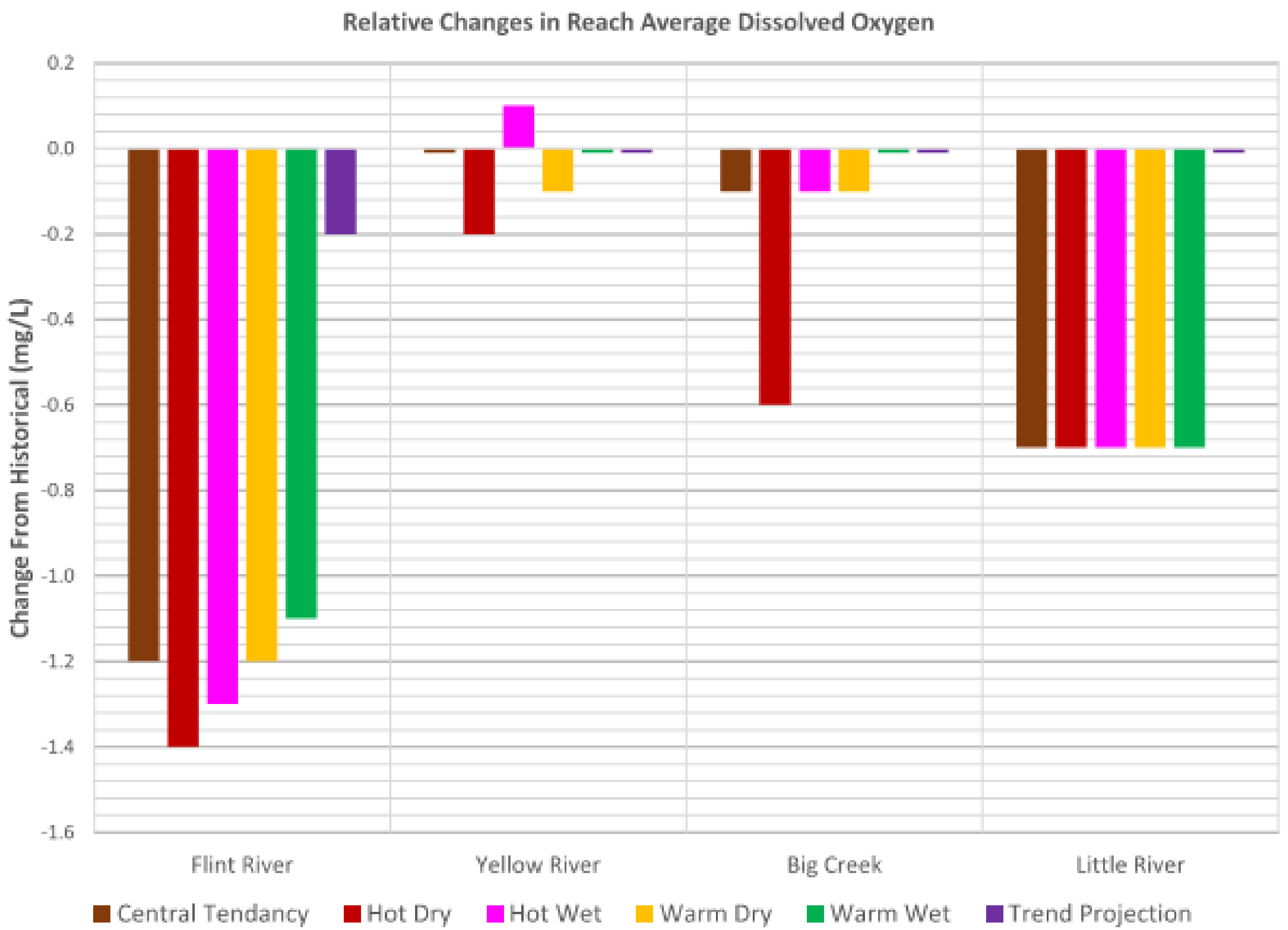
Simulate DO: Existing GA DOSAG Models



Water Quality Modeling Results: Water Temperature



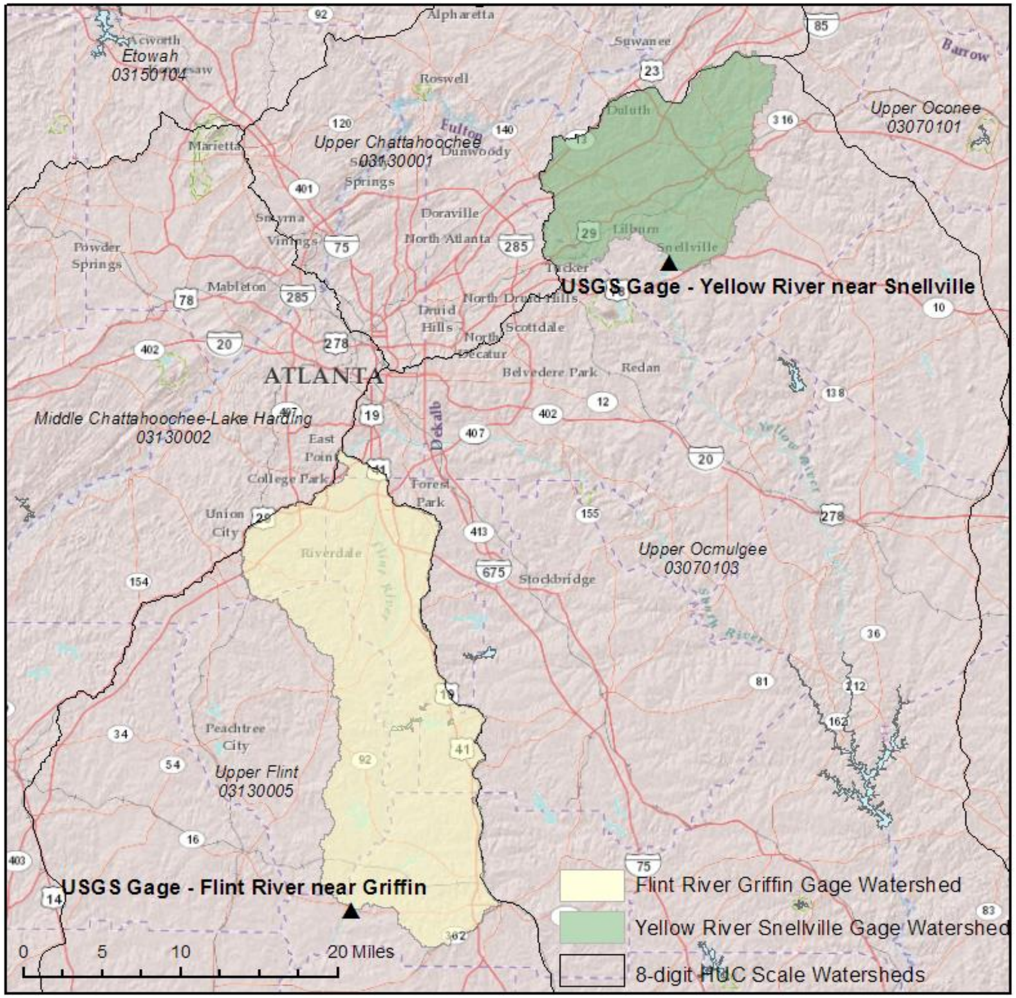
Water Quality Modeling Results: Dissolved Oxygen



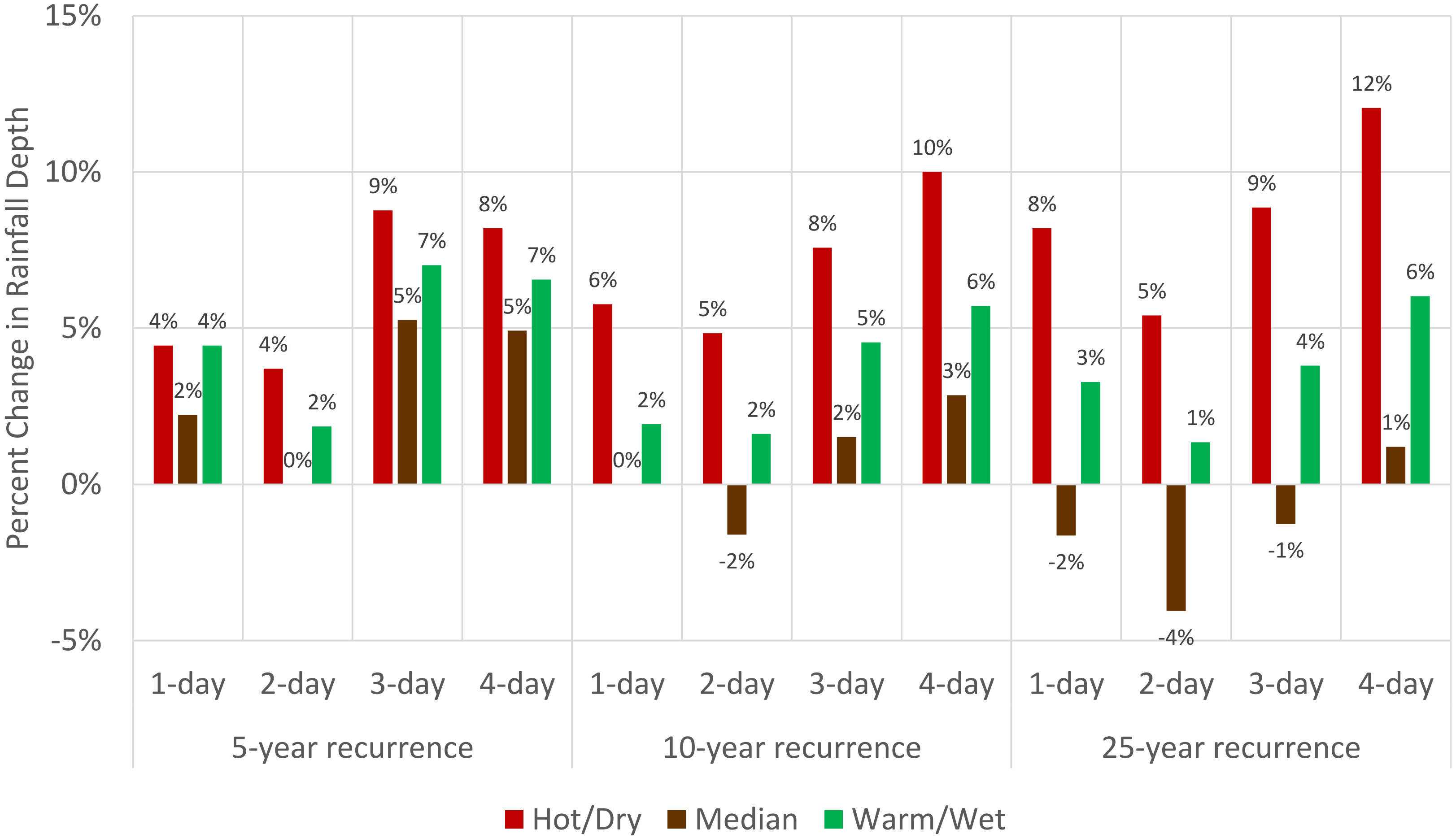
WATERSHEDS:
FLOODING / POLLUTANT LOADING

Methods to Evaluate: Flooding Vulnerability

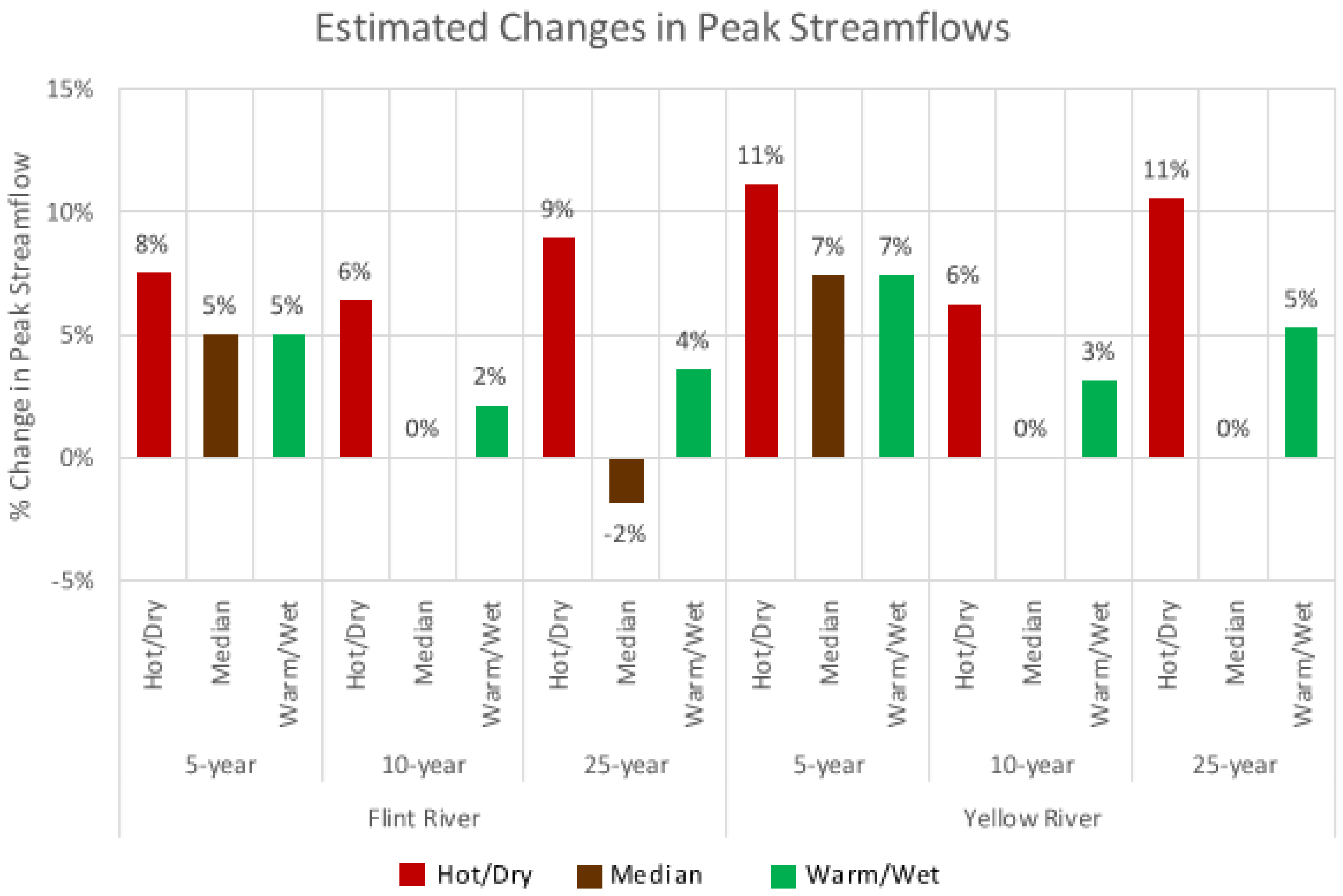
Land Use	Flint River Watershed 268 sq. mi.	Yellow River Watershed 127 sq. mi.
Residential	35%	60%
Agriculture	14%	1%
Commercial/ Industrial	8%	18%
Forest	24%	8%
Other	18%	13%



Projected Percent Changes in ARI Depths



Estimated Changes in Peak Streamflows



INFRASTRUCTURE & ADAPTATION

Water Facilities Risk Scorecard Example: Wastewater Treatment Plants

Impact to Wastewater Treatment Plants	Trend	Associated Climate Scenario	Sensitivity	Adaptive Capacity	Extent of Impact	Assumptions
Water Demand	Increase	CT, HD, HW, WD, WW, HT	Moderate	High	All	An increase in water demand may result in an increase in system flows (baseflow) and therefore, an increase in flows that require treatment. Treating more flow may increase wear and tear on wastewater treatment plant equipment.
	Decrease	Not Impacted				
Firm Yield	Increase	Not Impacted				Changes in firm yield and in withdrawals from water supply reservoirs will not impact operations of wastewater treatment plants.
	Decrease					
Dissolved Oxygen	Increase	Not Impacted				Dissolved oxygen levels in effluent to receiving water bodies may require changes in treatment processes to comply with regulatory standards.
	Decrease	CT, HD, HW, WD, WW, HT	High	Moderate	All	
24-Hour Storm Depths	Increase	CT, HD, WW*	High	High	All	If storm depths increase, combined sewage and stormwater may exceed the capacity of wastewater treatment plants that treat combined sewage, leading to releases of untreated or partially treated sewage into water ways. Treating more intense storms may increase wear and tear on wastewater treatment plant equipment. Flooding may also occur at the wastewater treatment plant as a result of surface flooding from intense storms.
	Decrease	Not Impacted				
Peak Streamflow	Increase	CT, HD, WW*	Moderate	Moderate	All	In the event that an increase in peak flows exceed the stream capacity, it may lead to an increase in stream stage. This may cause complications with treatment plant effluent, system backups, or surface flooding of the facility.
	Decrease	Not Impacted				
Nonpoint Source Pollutant Loads	Increase	CT, HD, HW, WD, WW, HT	High	Low	All	An increase in pollutant loads in receiving waters may lead to more stringent effluent pollutant load regulations, which wastewater treatment plants may not be currently configured to meet.
	Decrease	Not Impacted				

*Note: Only the Central Tendency, Hot/Dry, and Warm/Wet climate scenarios were evaluated for 24-Hour Storm Depths and Changes in Peak Streamflow.

CDM Smith

Example of Adaptation Recommendations

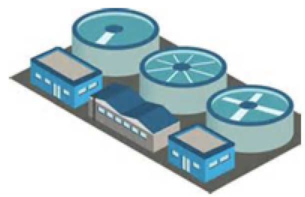
ISSUE	INCREASED DROUGHT FOR WTPs

Impact

Increased drought (change in Palmer Drought Severity Index of up to -4.29)

Potential Issues

Intake infrastructure at the water treatment plant may not be designed to pull from a lower water surface elevation



Critical Scenarios

- ✓ Central
- ✓ Hot/Dry
- ✓ Hot/Wet
- ✓ Warm/Dry
- ✗ Warm/Wet
- Trend

Key Adaptation Strategies

- **Monitor and inspect** existing infrastructure's capacity to handle drought.
- **Retrofit intakes** to accommodate lower water levels in reservoirs and decreased late season flows.
- Form utility-specific **drought management plans**.

Links to 2009 Water Supply Plan

- Prioritize actions associated with the **water conservation** program (Actions 5.1-5.12).
- Prioritize development of **local emergency water plans** (Action 9.2).

Summary

- Most Severe Climate Impacts: Hot/Dry scenario
- Most Specific Infrastructure Risks: Hot/Wet scenario
- Near-term recommendations include:
  - Establish climate tracking protocols and identify trigger levels for adaptive measures.
  - Incorporating preemptive adaptation measures
    - Green infrastructure
    - Drought Management Plans

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