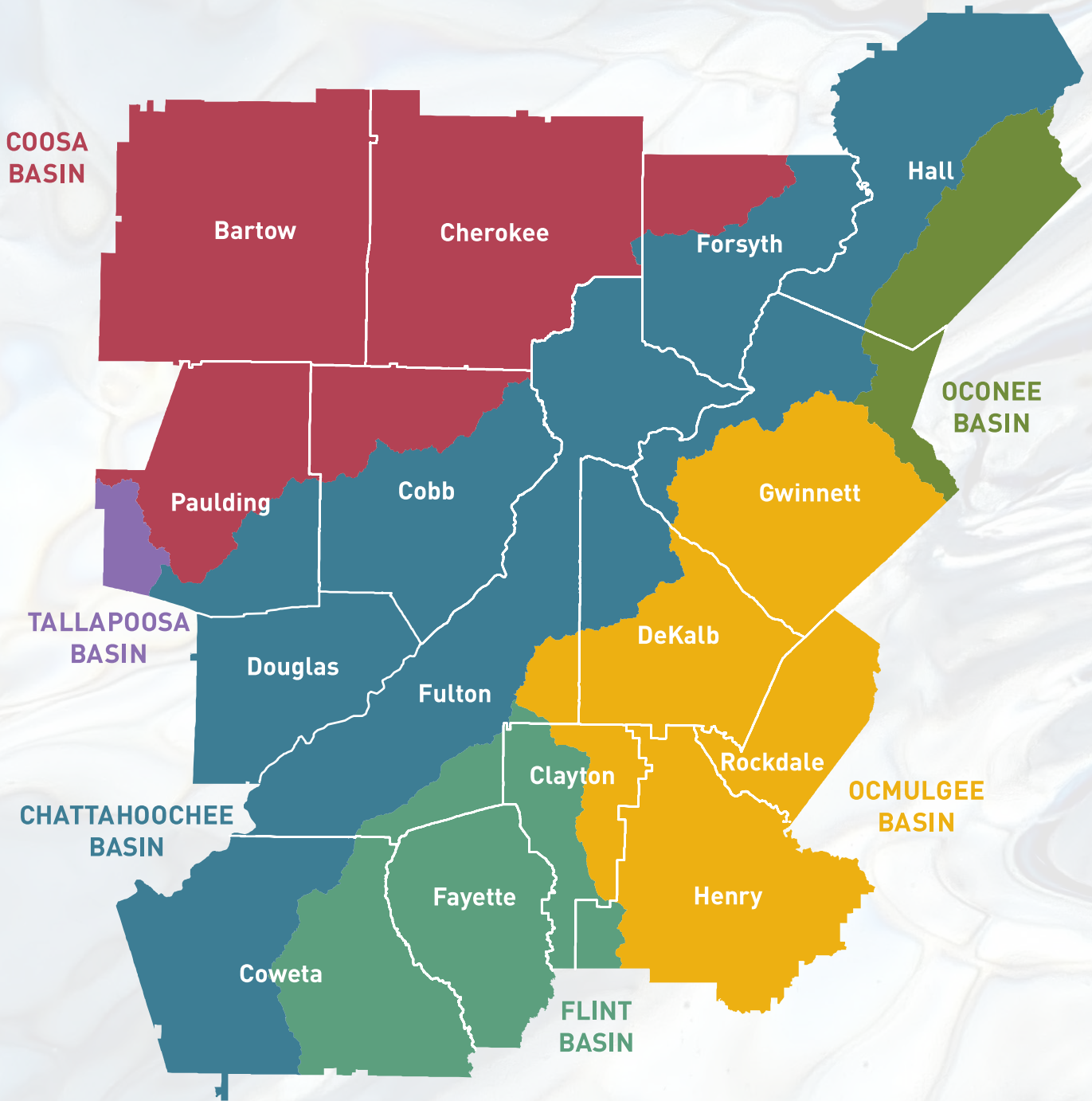


APRIL 2026

Metropolitan North Georgia Water Planning District

2026 RESILIENT WATER UTILITIES REPORT



About the District

The Metropolitan North Georgia Water Planning District (the District) was created by the Georgia General Assembly in 2001 as a regional water resources planning agency. The District develops comprehensive action items and strategies for the management of water supply and water conservation, wastewater, and stormwater for the 15-county, 97-city metropolitan Atlanta region, which serves over 5 million residents, and varied industry operations.



Metropolitan North Georgia Water Planning District

2026 RESILIENT WATER UTILITIES REPORT

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Glossary

Extreme Weather Event – A rare, severe or unseasonal event during a particular place and time of the year. This weather event occurs at the extremes of historical distribution and has unusual characteristics in terms of magnitude, location, timing, or extent.

Hazard Mitigation – Measures to reduce the impact of risks and vulnerabilities posed to assets and systems, such as actions or projects that can reduce or eliminate damage to equipment and disruption in service.

Recommended Actions – In this report, actions water utilities can take either in preparation or response to short-term and long-term climate change and extreme weather events to help manage uncertainty and avoid unnecessary financial strain.

Redundancy – A form of design that ensures built infrastructure is capable of providing consistent, and effective operation – not only when the system is working correctly, but also in the event of unpredictable circumstances such as equipment failure, higher than anticipated flows or loading, and natural disasters.

Resilience – The ability of assets, networks, operation, and systems to anticipate, absorb, adapt to and or rapidly recover from an extreme weather event.

Resilience Planning – Developing strategies that ensure the ability of water and wastewater utilities to withstand and quickly recover from natural and human-made disasters and other emergencies. Planning for resilience will help safeguard access to drinking water and properly treated wastewater.

Response and Recovery – Strategic actions to address both the short-term and long-term impacts of extreme weather events. This could include planning considerations such as staffing, funding, scenario response planning, water supply and demand management, and communications and partnerships.

Reliability – Designing and maintaining assets to operate under a range of conditions and mitigate damage or loss from an event.

Mutual Aid – An assistance network that provides water, stormwater, and wastewater utilities with the means to quickly obtain help in the form of personnel, equipment, materials and associated services from other utilities to restore critical operation impacted during any type of emergency, big or small.¹

¹ United States Environmental Protection Agency (US EPA). (2026, January 7). *Mutual Aid and Assistance for Drinking Water and Wastewater Utilities*. [www.epa.gov. https://www.epa.gov/waterutilityresponse/mutual-aid-and-assistance-drinking-water-and-wastewater-utilities](https://www.epa.gov/waterutilityresponse/mutual-aid-and-assistance-drinking-water-and-wastewater-utilities)



Abbreviations & Acronyms

2015 Study – 2015 District Utility Climate Resiliency Study

2026 Report – 2026 Resilient Water Utilities Report (this document)

District – Metropolitan North Georgia Water Planning District (MNGWPD)

FEMA – Federal Emergency Management Agency

GEFA – Georgia Environmental Finance Authority

GEMA/HS – Georgia Emergency Management & Homeland Security Agency

LOE – Level of Effort

NOAA – National Oceanic and Atmospheric Administration

US EPA – United States Environmental Protection Agency

WRM – Water Resources Management (Plan)



Table of Contents

Executive Summary 1

Introduction 5

Section 1: The Case for Climate Resilience Planning 9

 Climate Trends & Weather Events Update 9

 Temperature Change 9

 Precipitation Variability 12

 Extreme Weather Events 16

 Case Studies: Local Resilient Water Utilities 18

 Economic Implications: The Case for Investing in Resilience Planning 22

 Section 1 Conclusion 24

Section 2: Recommendations for Implementing Resilience Planning 25

 Planning for Future Weather Conditions 26

 Financing Infrastructure and Sharing Resources 31

 Fortifying Assets 33

 Continuity of Operations during Extreme Weather Events 40

Resources & Tools 43

 Available Funding for Resilience Planning 43

 State Resources 43

 Federal Resources 44

Conclusion 45

Appendix A – Resources & Tools 47



Executive Summary

Water Utilities in the Metropolitan North Georgia Water Planning District (the District) are facing unprecedented challenges as they plan for a future with increasing climate variability and extreme weather events. This report provides updated climate data to inform decision-makers and highlights strategies for enhancing resilience.

Key Takeaways

- ◆ A review of recent data confirms **trends of rising temperatures, greater frequency of droughts, and an increase in the number of extreme weather events.**
- ◆ Studies show early investment in resilience planning reduces long-term financial risk: **every \$1 spent on preparedness saves \$6 in disaster recovery costs and \$7 in community's economic costs.**
- ◆ Twenty-one District partners—including counties, cities, and water authorities—contributed through interviews, surveys, and focus groups which directed the recommended resilience strategies and interventions for utilities.
- ◆ Resilience recommendations fall into four primary categories: planning for future weather conditions; financing infrastructure projects; fortifying assets; and operations continuity during extreme weather events.
- ◆ Case studies from local governments and authorities demonstrate the value of taking proactive steps to build resilience, along with lessons learned for further improvement.

Summary of Climate Trends and Impacts

Temperature Increase

- ◆ Global and regional warming continues: the past 11 years represent the warmest on record globally, and **Georgia's average temperature has risen ~0.5°F per decade over the past 50 years.**
- ◆ Utility Impact: **increased operational expenses and accelerated capital improvement project timelines.** These **costs are driven by higher water demand and energy use.**

Precipitation Variability

- ◆ Georgia experiences periods of drought and heavy rainfall, with greater variability between wet and dry conditions.

- ✦ Utility impact: **increased compliance, treatment, and repair costs**, caused by increased flooding, erosion, nonpoint source pollution, reduced reservoir and infiltration capacity, and other infrastructure stress driven by periods of drought followed by intense rainfall.

Extreme Weather Events

- ✦ Extreme weather events are more frequent and intense: from 2015–2025, **cities and counties in the District faced at least 10 nationally declared disasters and 7 billion-dollar events**, including hurricanes, tornadoes, and winter storms.
- ✦ Utility impact: **substantial service disruptions** caused by power outages, blocked facility access, inundated and damaged infrastructure, and communication challenges driven by damage from extreme weather events.

Overview of Resilience Recommendations

Derived from literature reviews, District expertise, and stakeholder input, the recommendations fall into four categories highlighted below. The full report includes more detail on each recommendation, including key attributes such as estimated cost and level of effort, relevant sector and extreme weather events, and responsible parties, to help users assess feasibility and prioritize implementation within their organizations.

Planning for More Extreme Future Weather Conditions

- ✦ Design stormwater and wastewater infrastructure to handle larger storms.
- ✦ Evaluate land use policies for heat mitigation and stormwater management.
- ✦ Consider alternative water sources to augment current supplies.
- ✦ Incorporate recent trends and climate projections into decision-making.

Financing Infrastructure and Sharing Resources

- ✦ Set adaptive service rates and set aside emergency funds.
- ✦ Establish mutual aid agreements and resource-sharing protocols.

Fortifying Assets

- ✦ Mitigate flood risks by relocating or elevating critical infrastructure.
- ✦ Prioritize water supply service by identifying critical needs ahead of time.
- ✦ Enhance power redundancy through generators and renewable energy.
- ✦ Develop adaptable and proactive asset management programs.

Continuity of Operations During Extreme Weather Events

- ✦ Implement demand management strategies and advanced metering.
- ✦ Strengthen emergency communications and organizational checklists.

Proactive resilience planning not only safeguards public health, worker safety, and infrastructure but also delivers significant cost savings over time. The District faces hotter temperatures, highly variable precipitation, and increasingly frequent and severe storms. These trends threaten water demand and supply, while potentially elevating operational costs over time. However, preparation and early investment can save utilities money and make them more resilient in the long run. By implementing the peer-informed resilience strategies outlined in this report, utilities can reduce risk, protect assets, and help ensure reliable service for decades to come.





Introduction

The Metropolitan North Georgia Water Planning District (the District) published a [Utility Climate Resiliency Study](#) in 2015 (2015 Study) to evaluate future climate scenarios and analyze their potential impacts on water resources and infrastructure in the 15-county District. It also identified policies and projects local jurisdictions could implement to improve their resilience across all scenarios. This document – the **2026 Resilient Water Utilities Report** (2026 Report) – updates the 2015 Study, and provides new information about climate trends and impacts. It also offers updated recommendations for resilience planning that are actionable and relevant to both short-term and long-term needs.

The 2015 Study projected Georgia’s average temperature would continue to rise, with winters warming faster than summers. The study also expected precipitation patterns to remain highly variable, with periods of both drought and heavy rainfall.

The 2026 Report found that these anticipated trends remained in place. The District’s 15-county region has experienced a warmer and more variable baseline climate, with more frequent extreme weather events. This report provides additional weather and climate data, anecdotal experiences, and discussion to benchmark current conditions and trends against the 2015 Study projections. The 2015 Study summarized potential impacts on water supply, demand, and infrastructure within the District’s 15-county footprint. In the following decade, local partners experienced the impacts of a changing climate and the growing urgency to increase disaster preparedness and increase resiliency in their systems and infrastructure.

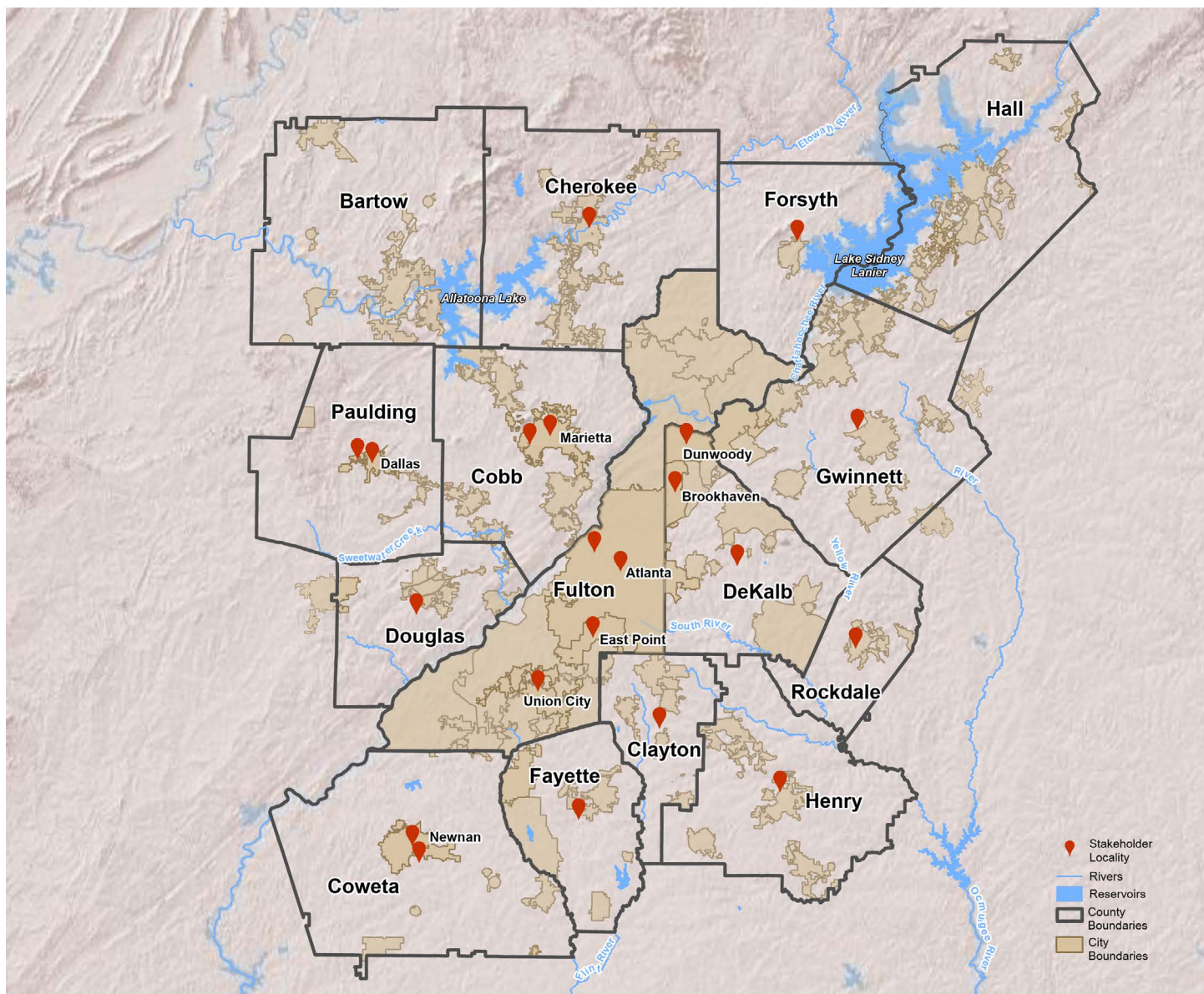
Stakeholders from across the District, who serve various sized systems and customer bases, contributed their knowledge and experience to the 2026 Report.

Stakeholder engagement methods included:

- ✦ **One-on-one interviews** with a variety of utility staff members (serving in roles such as a Resiliency Manager, Chief Operation Officer, Wastewater Treatment Superintendent, and Environmental Compliance Manager) to gather case studies and understand experiences and decision-making considerations.
- ✦ **A survey of the Technical Coordinating Committees** (watershed, wastewater, education, water conservation and water supply) to determine their needs and concerns regarding resiliency.
- ✦ **Focus groups** organized by expertise in (1) Communications, Sustainability, and Emergency Management, (2) Stormwater, Environmental Compliance, and Land Use, and (3) Wastewater and Drinking Water to respond to draft recommendations.
- ✦ **Email communications** to gather feedback and suggestions on drafted recommendations and case studies.

In total, 21 District partners were engaged, as shown in [Figure 1](#), and included counties, cities, and water authorities.

Figure 1. Geographical Distribution of District Stakeholders Engaged



This report is organized into two main sections: the “why” and the “how.” The first section summarizes climate trends, utility implications, economic impacts, and recent case studies from local jurisdictions and water authorities. This is followed by recommended strategies and tactics, alongside additional planning resources, tools, and existing funding opportunities.

Section 1: The Case for Climate Resilience Planning (the “Why”) offers an update on recent climate trends and extreme weather events, with examples of how water utilities could be impacted by these changes. This section also covers related implications for a utility’s ability to maintain operations, serve customers, and fund necessary upgrades to infrastructure and water treatment systems.



Section 2: Recommendations and Tools for Implementing Resilience Planning (the “How”) presents a set of recommended strategies for drinking water, stormwater, and wastewater sectors. Each recommendation identifies the relevant sector and provides an estimate of cost and level of effort, and other relevant factors. The recommendations are accompanied by implementation tools and funding resources also summarized in [Appendix A](#). As utilities prepare their infrastructure and workforce for future climate change and extreme weather, the tools and resources in this report are designed to support their resilience goals. These include evaluating vulnerabilities, running tabletop exercises, and exploring funding opportunities for resilience planning. By implementing these recommendations, utilities can enhance resilience to extreme weather events, safeguard water supply and public health, protect valuable infrastructure, and effectively meet service demand amid the challenges posed by a changing climate.



Section 1: The Case for Climate Resilience Planning

Shifts in temperature and precipitation are significant factors influencing utility planning and operations. These fluctuations may drive both drought stress and flooding risks within short time frames. Prolonged heat and drought conditions can strain water supply, lower reservoir levels, and cause water quality changes that increase treatment costs. Conversely, more intense rainfall events and increased storm frequency heighten risks of flash flooding, greater inflow and infiltration in wastewater collection systems, and more wear on stormwater collection and detention practices. Water infrastructure facilities in the District have recently been impacted by extreme weather events, including droughts, floods, hurricanes, and tornados. Without proactive planning for climate change, the resulting costs can add up quickly. However, preparation and early investment can save utilities money in the long run.

Climate Trends & Weather Events Update

Over the past decade, the District has experienced changes in annual average temperature and precipitation patterns and has been impacted by numerous extreme weather events. Data on climate trends and relevance to water utilities is presented below.



Temperature Change

Global average annual temperatures have continued to increase since the 2015 Study. At the time of its publication, 2015 was the warmest year since the mid-to-late 19th century.² More recently, the World Meteorological Organization reported that 2023 and 2024, respectively, were the warmest years on record,³ with 2025 the second or third warmest year.⁴ As such, not only were the last three years the three warmest on record, the past 11 years (2015–2025) now represent the warmest years on record.⁴

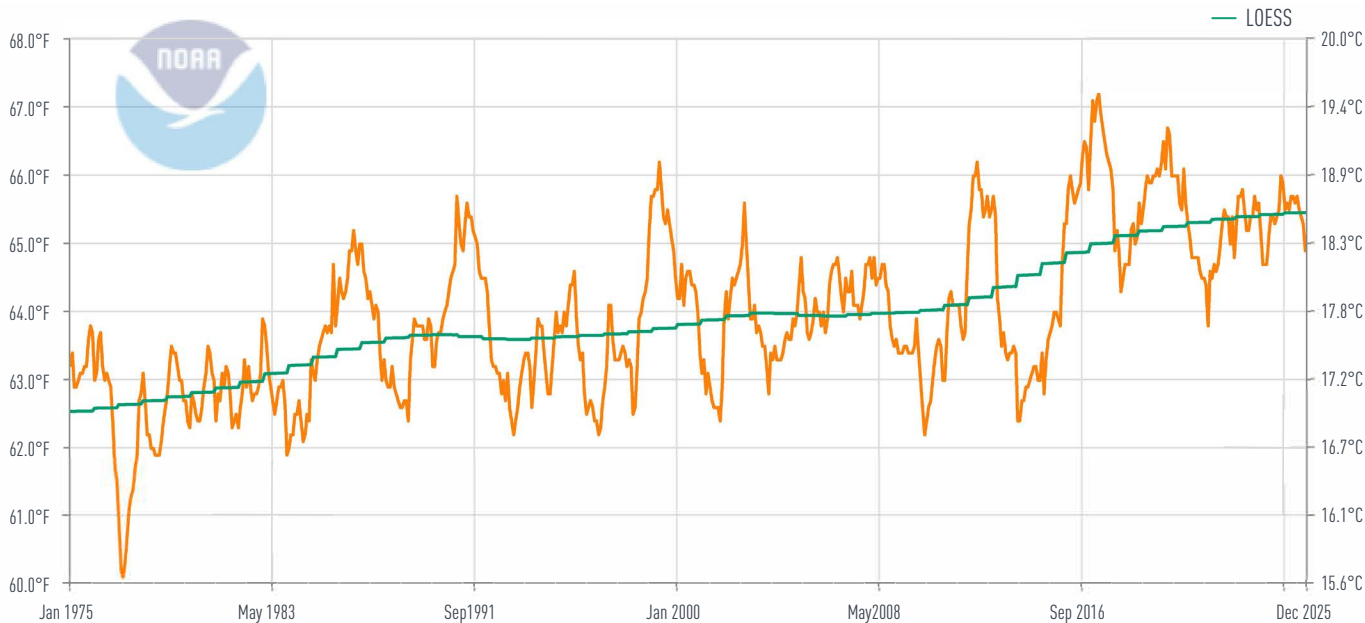
² National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI). (2016, November 16). *Reporting on the state of the climate in 2015*. <https://www.ncei.noaa.gov/news/reporting-state-climate-2015>

³ World Meteorological Organization (WMO). (January 10, 2025). *WMO confirms 2024 as warmest year on record at about 1.55°C above pre-industrial level*. <https://wmo.int/news/media-centre/wmo-confirms-2024-warmest-year-record-about-155degc-above-pre-industrial-level>

⁴ World Meteorological Organization (WMO). (2026, January 13). *WMO confirms 2025 was one of warmest years on record*. <https://wmo.int/news/media-centre/wmo-confirms-2025-was-one-of-warmest-years-record>

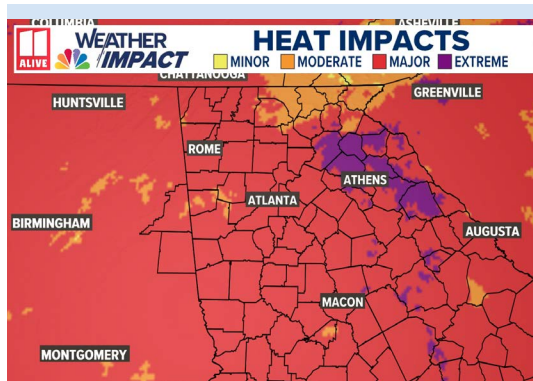
While global warming plays out differently at local levels depending on geography, Figure 2 shows a clear warming trend in Georgia.

Figure 2. Georgia 12-Month Moving Average Temperature from 1975 to 2025⁵



The orange line is moving average temperature, the green line is a fitted curve of the data (LOESS)

Georgia has seen an increase in annual average temperature of roughly 0.5°F per decade over the past fifty years.⁵ The state has also experienced uneven seasonal patterns, with Georgia winters (December-February) warming approximately three times faster than its summers (June-August),⁵ consistent with broader southeastern U.S. trends. This temperature increase has been felt by Georgians in rural, suburban, and urban areas alike.



Extreme heat was a critically relevant issue in the summer of 2025 when a record-breaking “heat dome” impacted much of the eastern United States, including parts of Georgia.⁶ Local news coverage from 11 Alive,⁷ WABE,⁸ and others communicated heat warning, alerts and impacts to the metro Atlanta area throughout June. This “heat dome” trapped hot air on earth’s surface for over a week, with daily highs exceeding seasonal averages by 10–15 °F across the region.

⁵ National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI). (n.d.). *Climate at a Glance | National Centers for Environmental Information (NCEI)*. Retrieved January 22, 2026, from <https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/statewide/time-series>

⁶ Roldan, A. (2025, June 27). *Blazing temps threaten both people and animals as heat wave rolls through Georgia*. Georgia Recorder. <https://georgiarecorder.com/2025/06/27/blazing-temps-threaten-both-people-and-animals-as-heat-wave-rolls-through-georgia/>

⁷ Nord, M., Landreth, R., & Holcomb, C. (2025, July 24). *Hottest temperatures of Summer send heat index over 105+*. 11Alive.com; WXIA. <https://www.11alive.com/article/weather/weather-impact/hottest-temperatures-of-summer-send-atlantas-highs-close-to-100/85-62ab59fb-1be2-4735-adcc-c3029639303d>

⁸ Murry, K. (2025, June 23). *Metro Atlanta counties open cooling centers amid heat wave*. WABE. <https://www.wabe.org/metro-atlanta-counties-open-cooling-centers-amid-heat-wave/>

Water Utility Impacts: Higher Temperatures

Presented below are examples of how higher temperatures directly affect regional water utilities, as well as the broader, cascading operational implications.

- ◆ Higher temperatures can lead to increased soil moisture loss via evapotranspiration.⁹
 - » This leads to reduced surface water baseflow and increased baseline water demand in warmer months, mainly for watering lawns and gardens.
 - » Higher water demand reduces water supply if not controlled, especially in drier months when surface water supply is less likely to be replenished by rainfall.
 - » For customers, lower supply could lead to water restrictions or higher costs.
 - » **Costs to utilities may include:**
 - ◆ More directed and intensive customer education and/or enforcement
 - ◆ Investment in new and alternative water supplies such as reservoirs, groundwater wells, or reuse facilities
- ◆ Higher average air temperatures can lead to increased surface water temperatures, which may negatively impact water quality.¹⁰
 - » This can impair the aquatic habitat by reducing oxygen levels and increasing nuisance algal growth (algal blooms).
 - » These impacts could lead to stricter point and nonpoint source pollution control standards to maintain water source quality.
 - » **Costs to utilities may include:**
 - ◆ Greater compliance and monitoring efforts
 - ◆ Additional water treatment processes
- ◆ More intense heat waves may increase energy demand for cooling, causing higher water demand and thus depletion of water supplies as well as increased energy costs.
 - » Thermoelectric power plants have historically been the largest users of water withdrawals in the U.S., especially for turbines and cooling.
 - » Electricity has historically been the largest expense in many water and wastewater treatment plant budgets.
 - » Rising temperatures will make this energy-water nexus more relevant to future water utility operations and budgets.
 - » **Costs to utilities may include:**
 - ◆ Increased energy bills
 - ◆ Revenue loss in the form of unpaid water bills as customers struggle with the combined increase in water and power costs
 - ◆ Unexpected costs and accelerated timelines for water supply expansion projects, as a result of unanticipated demands higher than forecasted

⁹ CDM Smith. (2015). *Utility Climate Resiliency Study* (p. ES-4, 2-9, 4-35). Metropolitan North Georgia Water Planning District. https://northgeorgiawater.org/wp-content/uploads/2024/01/MNGWPD_Utility-Climate-Resiliency-Study.pdf

¹⁰ CDM Smith. (2015). *Utility Climate Resiliency Study* (p. ES-5, 4-10, 4-27). Metropolitan North Georgia Water Planning District. https://northgeorgiawater.org/wp-content/uploads/2024/01/MNGWPD_Utility-Climate-Resiliency-Study.pdf

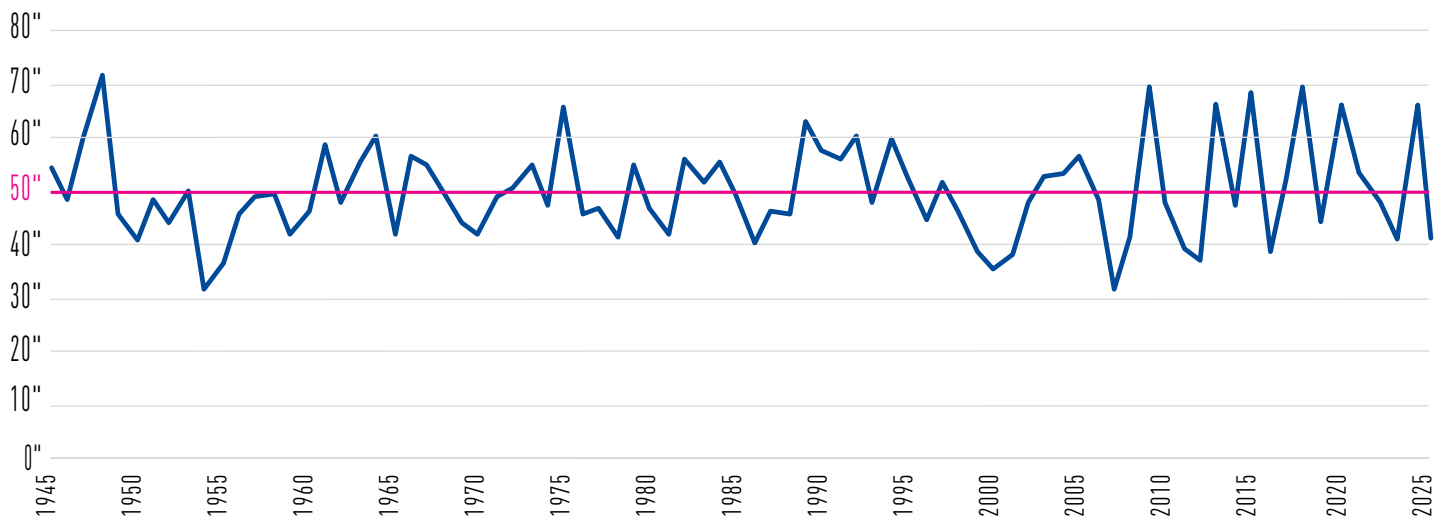


Precipitation Variability

While recent District and state rainfall data – presented in Figure 3, Figure 4, and Figure 5 – show no clear long-term trend up or down, it does indicate an increase in interannual variability characterized by pronounced wet and dry periods. District utilities now face greater precipitation variability – periods of both below and above average rainfall – which has weakened the effectiveness of past water supply and demand management assumptions and policies.

Figure 3 illustrates annual rainfall totals recorded at the Atlanta airport (representing metro Atlanta) from 1945 to 2025, and the corresponding average rainfall per year – about 50 inches.

Figure 3. Annual rainfall in metro Atlanta from 1945-2025¹¹



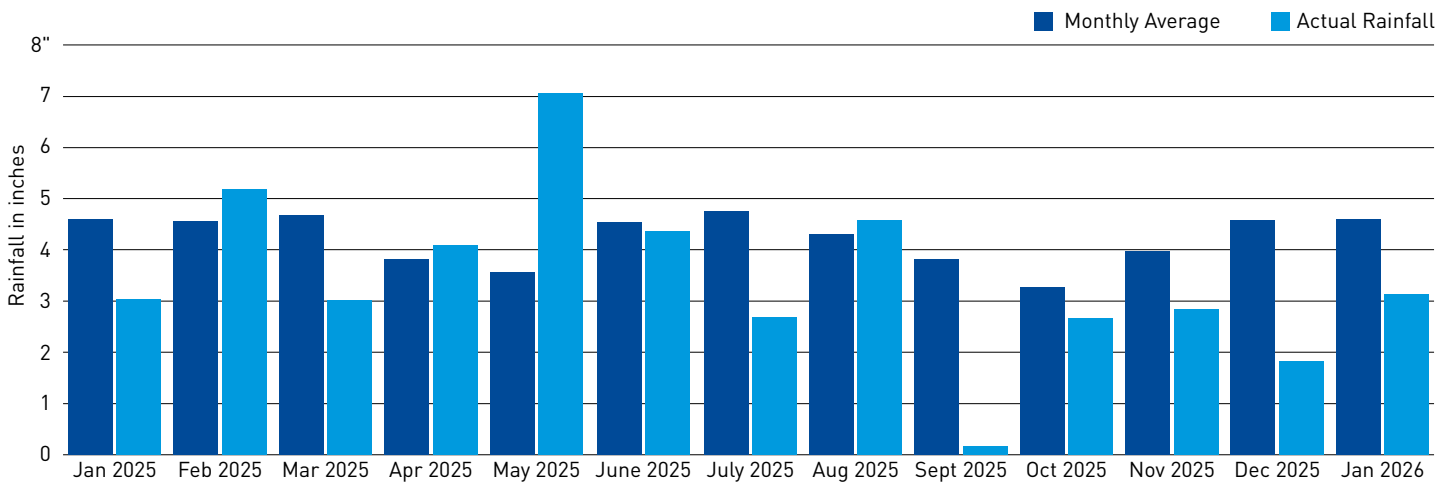
The blue line represents annual total rainfall, the pink line indicates the long-term average annual total rainfall (50 inches).

¹¹ Rainfall gathered from NOAA’s Atlanta Hartsfield-Jackson International Airport station rain gauge. See summary of rainfall at this gauge (monthly and annual) here: <https://www.weather.gov/wrh/Climate?wfo=ffc>

The last 25 years show greater variability in annual rainfall than in the previous 50 years. Meteorological conditions swing back and forth like a pendulum, between times of drought and heavy rainfall, with a sawtooth pattern emerging in more recent years. This pattern shows that the rainfall average tells only part of the larger precipitation story of our region. Variability from that average tells another.

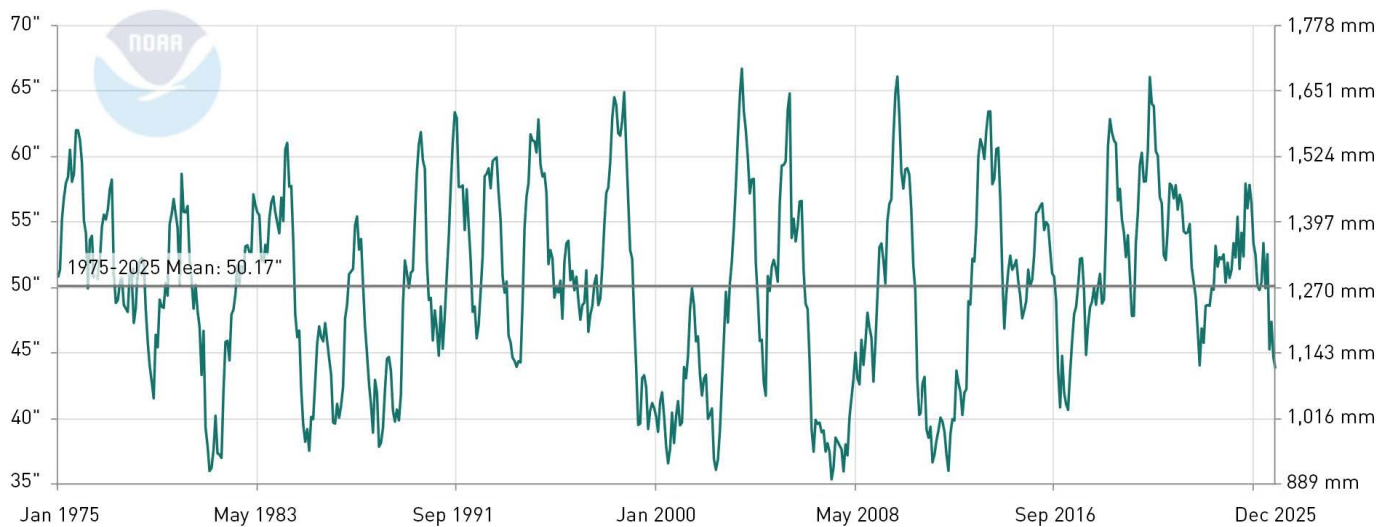
Short-term weather data can, in certain years, similarly show significant variability from historic average rainfall. Figure 4 illustrates actual monthly rainfall totals recorded at the Atlanta airport from the latest calendar year – January 2025 to January 2026 – and the corresponding historic average monthly rainfall. Few months in this period had rainfall close to the historic average: one month, May, received 3.5 inches above the average rainfall; seven months received actual rainfall less than 1 inch below average (September as much as 3.66 inches lower), resulting in a prolonged dry period at the end of the year.

Figure 4. Monthly actual rainfall versus monthly average rainfall in metro Atlanta from Jan 2025-Jan 2026¹¹



Tracking precipitation averages over time has been a standard and useful practice for understanding and managing our regional water supply. But Figure 3 and Figure 4 show that averages can be misleading. While the long-term annual average rainfall is about 50 inches, more recently our region has experienced longer dry spells and more intense short rain bursts, with more variability and less consistency from month to month and from year to year. The average is part of the story, but variability is the other. Planning in the future should consider both.

Figure 5 shows that in the past two decades, the state of Georgia has also experienced more extreme periods of drought and above-average rainfall in quicker succession.

Figure 5. Georgia Rolling 12-Month Precipitation Totals from 1975 to 2025¹²

Historical precipitation data shown in Figure 5 indicate that the 2005-2014 decade was notably drier than average, with an annual average of 48.0 inches. Severe drought conditions occurred in 2007-2008 and 2011-2012. Despite this overall dryness, there were wet-year extremes such as 2009, which included 9.08 inches of rainfall in December alone, and 2013, when July and August together received more than 17 inches of rainfall. In contrast, the most recent decade from 2015-2024 was wetter than average, with an annual average of 52.7 inches. Several years were exceptionally wet, including 2018, which recorded 9.63 inches of rainfall in December, 2020-2021, and 2024 when September rainfall reached 8.45 inches. While this decade was wetter than average for Georgia, some years experienced relatively low rainfall. Notably, 2016 had only 40.9 inches annually, with two months receiving less than 2 inches, and 2019 included an extreme low of 0.89 inches in September.

Water Utility Impacts: Precipitation Variability

Below are examples of the direct and cascading impacts of increased regional precipitation variability on water utilities.

- ✦ Extremely low water levels in streams, lakes, and reservoirs caused by low precipitation may lead to elevated water temperatures and decreased capacity of these water bodies to dilute contaminants.¹³
 - » These impacts could lead to stricter point and nonpoint source pollution control standards to maintain water source quality, along with discharge limits.
 - » In turn, this could strain reservoirs that must supply both drinking water and downstream base flow.
 - » **Costs to utilities** may include:
 - Greater compliance and monitoring efforts
 - Additional water treatment processes
 - Building an alternate water supply

¹² National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI). (n.d.). *Climate at a Glance | National Centers for Environmental Information (NCEI)*. Retrieved January 22, 2026, from <https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/statewide/time-series>
To recreate this Figure: select Georgia, Precipitation, 12-Month time scale, All Months, start yr 1975, end yr 2025, check display base period 1975-2025

¹³ CDM Smith. (2015). *Utility Climate Resiliency Study* (p. ES-5, Section ES.3.3). Metropolitan North Georgia Water Planning District. https://northgeorgiawater.org/wp-content/uploads/2024/01/MNGWPD_UTILITY-CLIMATE-RESILIENCY-STUDY.pdf

- ◆ Increased peak stream flows caused by extreme rainfall will likely result in increased flooding, erosion, and nonpoint source pollution.¹⁴
 - » Intensified flooding and erosion increase risk of infrastructure failures such as sinkholes, sewer pipe crossing collapses, submerged outfalls, and backups to treatment facilities.
 - » Increases in nonpoint source pollution lead to further degradation in water quality (e.g., more algal blooms, more suspended solids due to erosion, lower oxygen levels).
 - » **Costs to utilities** may include:
 - More frequent repairs to stressed and damaged conveyance infrastructure
 - Expensive emergency repairs
 - Redesign or rehabilitation of treatment plants in low-lying areas
 - Additional source water treatment and equipment maintenance to mitigate grit and sediment
- ◆ Firm yield¹⁵ in drinking water reservoirs could rise or fall.
 - » Differences between actual reservoir conditions during a recent drought of record and those used in the original firm yield analysis can lead to inaccurate water supply forecast.
 - » If firm yield decreases, utilities may see the need to build large capital projects like new reservoirs or reuse systems earlier than anticipated.
 - » **Costs to utilities** may include:
 - Changes in reservoir operations and management plans
 - Construction costs
- ◆ Prolonged periods of drought followed by intense rainfall lowers infiltration capacity.¹⁶
 - » Extended dry periods harden soil surfaces, especially clay and rock, reducing the ability of soils to absorb heavy rain and stormwater runoff.
 - » Reduced infiltration capacity leads to greater runoff volume.
 - » **Costs may be incurred by both customers and utilities** from increased localized flooding of private and public property.
 - » **Costs to stormwater programs and utilities** may increase if undersized infrastructure is damaged more frequently, leading to higher maintenance costs and potential capital expenditures for repair or replacement.
 - » **Costs to the environment** may include:
 - Reduced groundwater recharge
 - Elevated contaminant loads—such as sediments, hydrocarbons, and organic waste—that accumulate on impervious surfaces during extended dry periods and are later washed into surface waters during high-runoff events

¹⁴ CDM Smith. (2015). *Utility Climate Resiliency Study* (p. ES-6, Section ES.3.4). Metropolitan North Georgia Water Planning District. https://northgeorgiawater.org/wp-content/uploads/2024/01/MNGWPD_Utility-Climate-Resiliency-Study.pdf

¹⁵ Firm yield of a reservoir is the maximum yield that could have been delivered without failure during the historical drought of record.

¹⁶ University of Georgia (UGA) Institute for Resilient Infrastructure Systems (IRIS). (2025). Georgia Statewide Resilience Assessment: Hazards, Challenges & Opportunities. In *Resilience Planning for the State of Georgia* (p. 20). <https://sbuckleit.wordpress.com/wp-content/uploads/2025/08/garesilienceassessment-final2-compressed.pdf>



Extreme Weather Events

In many cases, water utilities in the District have experienced direct impacts from extreme weather events. In the last five years, Georgia has experienced more major natural disasters than in the two preceding decades.¹⁷ Additionally, observations in the Fifth National Climate Assessment conclude that there has been an increase in the severity, extent, and frequency of extreme weather events and that the Southeast has historically experienced more billion-dollar disaster events than the rest of the country. Therefore, Georgia is among the group of states that experience the greatest number of billion-dollar disasters in the U.S.¹⁸

In the last ten years, from 2015 to 2025, counties and cities within the District experienced at least 10 nationally declared natural disasters,¹⁹ and seven billion-dollar disasters.²⁰ These included droughts, hurricanes, floods, and severe storms with high winds, tornados, snow and freezing temperatures. Notable extreme weather events included Hurricane Irma (2017), Tropical Storm Zeta (2020), and Hurricane Helene (2024). Severe thunderstorms and tornado outbreaks have also occurred, such as the EF-4 tornado that struck Newnan in March 2021. Damaging winter storms and cold snaps took place in 2017, 2022, and early 2025. While this report and the following case studies focus on impacts from memorable and high-cost events, many other undeclared events have impacted local jurisdictions.

¹⁷ University of Georgia (UGA) Institute for Resilient Infrastructure Systems (IRIS). (2025). Georgia Statewide Resilience Assessment: Hazards, Challenges & Opportunities. In *Resilience Planning for the State of Georgia* (p. 4). <https://sbuckleit.wordpress.com/wp-content/uploads/2025/08/garesilienceassessment-final2-compressed.pdf>

¹⁸ National Oceanic and Atmospheric Administration (NOAA). (2023). Fifth National Climate Assessment. In *NOAA Institutional Repository* (pp. 22-9). U.S. Global Change Research Program. <https://repository.library.noaa.gov/view/noaa/61592>

¹⁹ Based on FEMA's *Disasters and Other Declarations* database (FEMA, 2025); the National Integrated Drought Information System (NIDIS) *Georgia* database (NIDIS, 2026) in partnership with NOAA, USDA, and NDMC; GAEPD's *Drought Management* Drought Indicators Reports (GAEPD, 2025); NOAA's NCEI *Billion-Dollar Weather and Climate Disasters Georgia* database (Smith, 2020).

²⁰ Events are defined as Billion-Dollar Disasters if the overall damages/costs reached or exceeded \$1 billion USD, including CPI (consumer price index) adjustment to 2024.

Smith, Adam B. (2020). *U.S. Billion-dollar Weather and Climate Disasters, 1980 - present* (NCEI Accession 0209268). [Georgia]. NOAA National Centers for Environmental Information (NCEI). Dataset. <https://www.ncei.noaa.gov/access/billions/events/GA/2014-2024/?disasters%5b%5d=all-disasters>

Water Utility Impacts: Extreme Weather Events

Below are examples of direct impacts of extreme weather events on water utilities, along with resulting cascading impacts.

- ◆ Wind damage from extreme weather events can cause power supply disruption.
 - » Many water systems are not able to treat or transport water without backup power.
 - » Water services are disrupted until power is restored.
 - » **Costs to utilities** may include:
 - Loss of revenue
 - Reduced customer trust in reliability
 - Increased staff time to restore and check functionality of power-reliant systems following a power outage
- ◆ Transportation routes to facilities may be blocked by debris and downed trees.
 - » Operators and other water facility staff may find it difficult to report to work, causing staff shortages.
 - » Haulers may have difficulty accessing the facility, leading to chemical shortages at water treatment plants or excess biosolids accumulation at wastewater treatment plants. Both could cause logistics challenges or disruptions to operations.
 - » **Costs to utilities** may include:
 - Cost and time to clear and clean up roads
 - Treatment process disruptions could lead to various increased temporary expenditures necessary to return system to normal operation
- ◆ Uprooted trees can damage nearby water infrastructure, including pipes, concrete, manholes, and buildings.
 - » **Costs to utilities** may include:
 - Cost and time to replace and repair damaged infrastructure
 - Loss of revenue from service disruption or from water loss caused by infrastructure failures
 - Contractor surcharges for services due to high demand in aftermath of storms



Case Studies: Local Resilient Water Utilities

When asked about the types of events that affected utilities, District stakeholders named specific events such as Hurricane Helene in 2024 and the “Christmas Freeze” in 2022. The following case studies illustrate how these extreme weather events impacted water, wastewater, and stormwater utilities within the District and across the Southeast.

Hurricane Helene (2024)

Although metro Atlanta was largely spared a direct hit when Hurricane Helene changed course to head east, stakeholders in the District reported the following impacts:

- ✦ **Dam spillways activated** due to intense rainfall
- ✦ **Spills** caused by larger flows into wastewater treatment plants and collection systems compared to typical storm events, likely due to operating at peak flow for almost 24 hours and experiencing greater infiltration and inflow (I&I)
- ✦ **Access to facilities blocked** by road closures caused by flooding and large debris
- ✦ **Flooding** was experienced in the aftermath of the storm
- ✦ **Long-term power outages** caused by wind, fallen trees, and downed power lines

Case Study: Columbia County, GA

While Columbia County is not located in the District, utilities in the jurisdiction were severely impacted by Helene and shared lessons that are relevant to the District. Columbia County had more than twice as much debris as any other county in Georgia from a single weather event – approximately 28,000 acres. Downed trees blocked access to pump stations, tore hydrants out of the ground, and prevented staff from leaving their homes. All county Water and Wastewater facilities lost power for an extended period of time. Cell and landline communication were cut off. Table 1 provides examples of how the County’s staff effectively prepared for and responded to the storm.



Table 1. Columbia County case study on Hurricane Helene experience

Before	During	After
<p>Existing Preparedness Plan set them up for success.</p>	<p>Leadership handled one problem at a time through thoughtful prioritizing.</p>	<p>Water treatment plants provided potable water to serve a nearby base until their system was operational.</p>
<p>Secured a reliable contractor to provide backup power in case of a power outage.</p>	<p>Took care of employees²¹ by:</p> <ul style="list-style-type: none"> • Ascertaining meals for crews • Enforcing the buddy system • Keeping crews already familiar with each other together 	<p>Water utility employees were called upon to quickly help clear debris and downed trees.</p>
<p>Employees were well trained.</p> <ul style="list-style-type: none"> • Multiple staff were trained to properly use a chainsaw. • Certified wastewater operators were trained to be familiar with solutions for adjusting facility operations following changes in inflows and other conditions. 	<p>Coordinated with other county staff to get the resources they needed:</p> <ul style="list-style-type: none"> • Fleet Services refueled water utility generators. • Columbia County staff shared radios and emergency communication channels when landlines and cell phones weren't working. 	<p>Assigned a staff member to inventory radios and retain spare parts inventory.</p> <p>Initiated radio training program and developed a usage guide.</p>
<p>Before the storm made a direct hit, one of the water utility's Water Pollution Control Plants (WPCP) flooded.</p>	<p>WPCP operators and maintenance staff rebuilt the UV system that was damaged during flooding.</p>	<p>Purchased additional spare parts to be prepared in a future similar scenario.</p>
<p>Generators were installed at WPCPs as sources of temporary backup power.</p>	<p>The backup generators operated as anticipated, but because the outage was prolonged the WPCP operators were not able to turn aeration back on; eventually, the "bugs"²² died.</p>	<p>Operators at the WPCPs conducted a successful transfer and recovery process to bring "bugs" from unaffected facilities to the WPCPs that lost their "bugs."</p> <p>Seeking grant funding for larger generators at these facilities.</p>
<p>SCADA²³ was outfitted with battery backups for power outages.</p>	<p>The battery backups were not sufficient to span the extended power outages.</p>	<p>Installed solar panels at SCADA centers to provide additional power generating redundancy.</p>

²¹ Columbia County Water Utility staff were doing the important work of clearing roads, giving out food and water while themselves being personally affected by trees falling on homes, blocking roads, and taking out power in their neighborhoods.

²² Microorganisms such as bacteria and protozoa that are necessary to clean and break down the waste in wastewater treatment plants. Smith, C. (2017, June 30). Featured Video: Wastewater Microbiology. [Wateroperator.org](https://wateroperator.org); University of Illinois at Urbana-Champaign. <https://wateroperator.org/blog/Tag/wastewater-bugs>

²³ SCADA stands for Supervisory Control and Data Acquisition

Columbia County Water Utility staff identified the following long-term resilience measures in response to Hurricane Helene:

- ◆ Added a line item for additional radios to the annual budget and created agreements with Columbia County Management to allow access to radio channels during emergencies. The water utility found that having more ways of communicating between employees and agencies was vital to their emergency response and recovery.
- ◆ Installed solar panels at SCADA centers to provide power redundancy. The water utility found that solar power provides immediate and longer-lasting backup power following a large storm, enabling them to operate plants remotely if access to facilities is blocked. These units will be built and installed by Columbia County Water Utility staff.
- ◆ Created a public education video to show people how to avoid covering water meter boxes when curbing debris.²⁴
 - » Debris covering meters made it difficult for staff to read meters properly.
 - » Heavy debris caused breaks and leaks to meters and related infrastructure.

Christmas Freeze (2022)

A winter storm and powerful arctic front brought heavy rains, snow, ice and high winds to the District and sent temperatures plummeting below freezing for consecutive days between December 21-26, 2022. Impacts included frozen water pipes that caused extensive water damage to many houses and businesses as well as other critical infrastructure. Stakeholders in the District interviewed for this report noted the following impacts:

- ◆ Burst fire lines
- ◆ Numerous privately owned pipe breaks and leaks
- ◆ Rapidly falling tank capacities
- ◆ Drained water supply
- ◆ Extreme water demand; some reported highest-ever levels

Case Study: Henry County Water Authority

The Christmas Freeze in 2022 caused extreme customer demand when pipes burst and large leaks had to be identified and addressed – at a time when many customers were not home. A tornado hit soon after, shutting down one of the utility’s water treatment plants for two days.

The following table (Table 2) shows how the Authority prepared for extreme weather events, how they responded during the crisis, and subsequent steps they took to further build resilience.

²⁴ Columbia County, GA Government. (2024). Be mindful not to cover up water meters, fire hydrants, storm drains, or other utility equipment. [Facebook Video]. In Facebook. <https://www.facebook.com/ColumbiaCityGa/videos/564897419236229/>

Table 2. Henry County Water Authority's (HCWA) experience with the 2022 Christmas Freeze

Before	During	After
<p>Fully mapped water system in geographic information system (GIS).</p>	<p>GIS mapping and advanced metering infrastructure (AMI) allowed real-time data monitoring to:</p> <ul style="list-style-type: none"> • track unusually high, constant consumption (potential leaks) during the event. • find large leaks and water loss at specific locations/customer side pipes. • enable proactive notification to customers via robocalls. • route field staff to high-consumption locations as needed. 	<p>Set up additional pressure monitoring techniques in all zones throughout the system to track the pressure that can result in large losses and to extend the life cycle of infrastructure assets.</p>
<p>Installed AMI (78% implementation as of 2025).</p>	<p>Using AMI data, the Customer Service team could advise customers with concerns related to leaks by checking whether their property was still showing constant water consumption.</p>	<p>Continued meter installation and data monitoring:</p> <ul style="list-style-type: none"> • Continue meter changeout program to smart meters for goal of 100% AMI implementation. • Maintain a large-meter testing program to ensure accurate measurement and effective water loss detection.
<p>Communicated best practices with the public ahead of a freeze, such as:</p> <ul style="list-style-type: none"> • dripping faucets • insulating pipes • turning water off at meter when traveling. <p><i>Note: These were posted on the HCWA website and social media platforms.</i></p>	<p>Communication during the event was targeted to specific customers/ locations rather than relying on general media notifications:</p> <ul style="list-style-type: none"> • When field personnel were deployed, they either updated the customer directly or by leaving a notice if the customer was not at the property. • Where leaks were identified on private property, customers were encouraged to seek a qualified professional for repairs and utilize HCWA's proof-of-repair program to potentially receive a bill adjustment. 	<p>Coordinated with a local news station to create a video providing a demonstration and tips for dealing with winter weather.</p> <p>Developed an action plan that is now in place to prepare HCWA for disaster and catastrophic events that may affect customers and core business processes.</p> <ul style="list-style-type: none"> • Plan begins with coordination between the safety team and internal leadership. • Includes communications through local news, social media, and clear internal guidelines for staff.

Before	During	After
<p>Evaluated existing interconnections with neighboring water systems as part of a 2020 Drought Contingency Plan.</p>		<p>HCWA decided to reevaluate interconnections with neighboring utilities and add new bypass connections as determined necessary.</p>
	<p>Power at water treatment plant was down for two days shortly after the freeze when hit by a tornado.</p>	<p>Backup generator was installed at water treatment plant.</p>

Additional examples of long-term resilience planning in the District that came out of lessons learned from the Christmas Freeze of 2022 included:

- ✦ *City of Dallas Wastewater (Paulding County)* – In response to frozen pipes, the wastewater treatment plant added electric heat tracing and insulation on outdoor above-ground lines.
- ✦ *Douglasville-Douglas County Water & Sewer Authority* – After experiencing record-high demand at its water treatment plant due to multiple private water line breaks, the authority updated its Cold Weather Operations procedures. Moving forward, during periods of extreme cold, the authority will maintain its distribution system storage tanks at full capacity before and throughout each cold weather event to better absorb unexpected peak demands.
- ✦ *Clayton County Water Authority* – Because of the Christmas holiday, staffing levels were reduced, and icy road conditions prevented some employees from reporting to work. In response, the authority updated its Emergency Response Plan to better address similar incidents in the future, including clarifying which agencies and utilities require direct communication.

Economic Implications: The Case for Investing in Resilience Planning

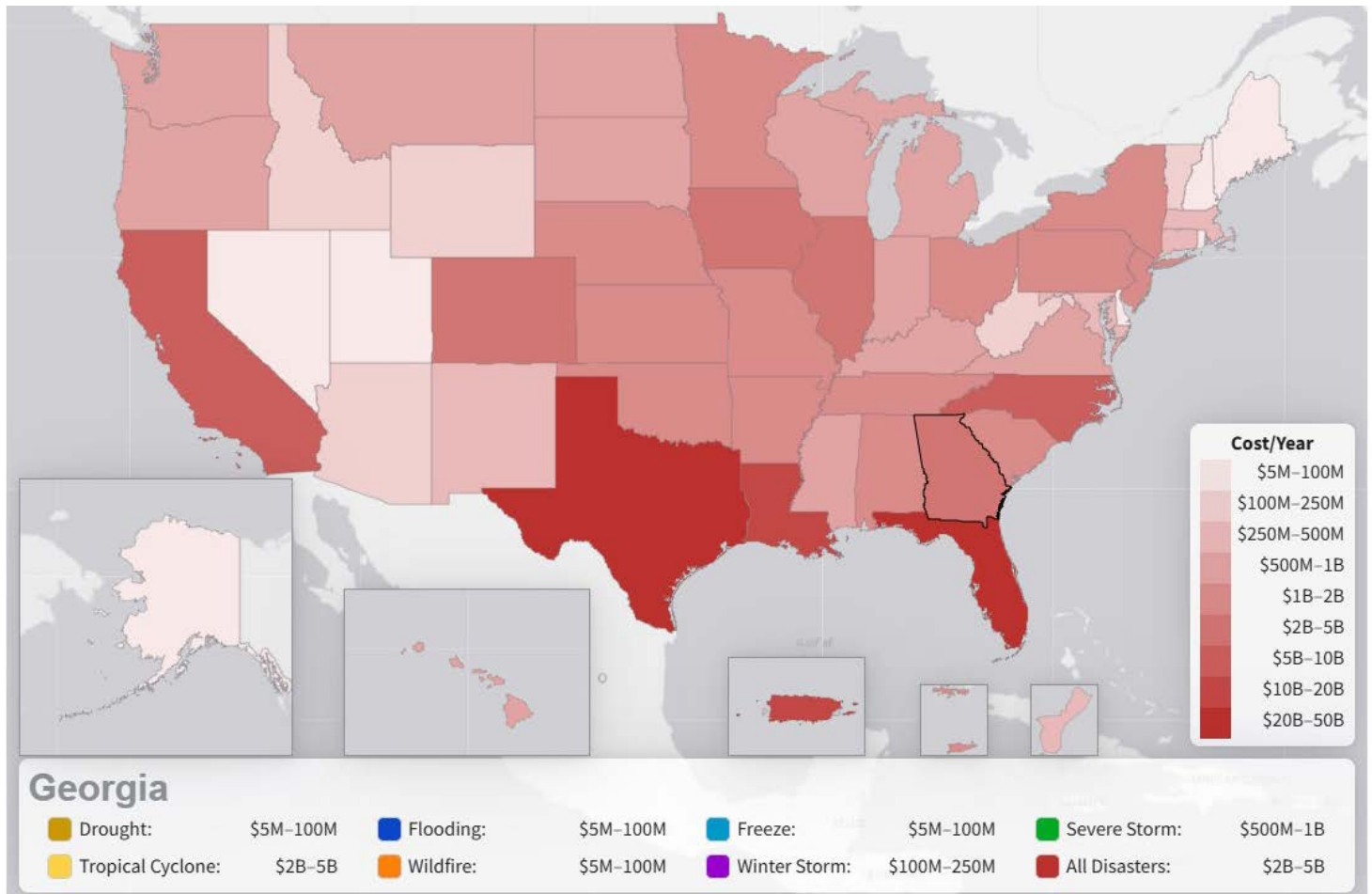
Between 1980 and 2024, the state of Georgia experienced 134 billion-dollar disasters totaling \$1.2 trillion.²⁵ The estimated cost per year for Georgia attributed to these billion-dollar disasters has more than doubled in the last ten years compared to the previous forty.²⁶ [Figure 6](#) details the breakdown of the type of disaster and estimated impact. A number of factors are at play, such as greater frequency and severity of events, increased value of development in areas with higher vulnerability, plus inflation, and other economic factors.

²⁵ Smith, A. B. (2020). U.S. Billion-dollar Weather and Climate Disasters, 1980 – present NCEI Accession 0209268; NOAA National Center for Environmental Information (NCEI). <https://www.ncei.noaa.gov/access/billions/events/GA/2014-2024/?disasters%5b%5d=all-disasters>

To recreate the same data: go to events tab, select Georgia, 1980-2024 time scale, All Disasters, and check with CPI-Adjusted (2024 Consumer Price Index (CPI) adjustment applied to estimate cost in billions)

²⁶ The NOAA NCEI billion-dollar weather and climate disasters dashboard provides an estimated cost per year for each state, which shows Georgia experiencing \$1-\$2 billion per year in the timeframe 1980 to 2024. However, limiting the analysis to 2014-2024, the estimated cost per year more than doubles to \$2-\$5 billion per year, which is shown in Figure 6.

Figure 6. Billion-Dollar Weather and Climate Disaster Cost/Year for Georgia based on 2014-2024 data²⁷



Please note that the map reflects a summation of billion-dollar events for each state affected (i.e., it does not mean that each state shown suffered at least \$1 billion in losses for each event).

Preparation and early investment are proven to create cost savings in the long run. A National Institute of Building Sciences study of public sector mitigation funded over 23 years through the Federal Emergency Management Agency, U.S. Department of Housing and Urban Development, and U.S. Economic Development Administration found that \$1 of federal investment in resilience and preparedness reduces the damage and cleanup costs of a disaster by \$6.²⁸

Another study by the U.S. Chamber of Commerce, U.S. Chamber of Commerce Foundation, and Allstate Insurance Company found that this \$1 investment can further reduce a community’s economic costs by \$7.²⁹ The study found this to be true across larger metropolitan areas and smaller rural areas and towns, as well as for both more severe major disasters and less severe events.

²⁷ Smith, A. B. (2020). U.S. Billion-dollar Weather and Climate Disasters, 1980 – present NCEI Accession 0209268; NOAA National Center for Environmental Information (NCEI). <https://www.ncei.noaa.gov/access/billions/events/GA/2014-2024/?disasters%5b%5d=all-disasters>

To recreate this Figure: go to disaster mapping tab, select map cost/year, 2014-2024 time scale, All Events, then select Georgia.

²⁸ National Institute of Building Sciences (NIBS). (2019). *Mitigation Saves: Federal Grants Provide a \$6 Benefit for Each \$1 Invested*. Nibs.org; NIBS. https://nibs.org/wp-content/uploads/2025/04/ms_v3_federalgrants.pdf

²⁹ U.S. Chamber of Commerce, U.S. Chamber of Commerce Foundation, & Allstate. (2024, June 25). *The Preparedness Payoff: The Economic Benefits of Investing in Climate Resilience*. Uschamber.com; U.S. Chamber of Commerce. <https://www.uschamber.com/security/the-preparedness-payoff-the-economic-benefits-of-investing-in-climate-resilience>

Section 1 Conclusion

The trends shown in Figure 2, Figure 3, Figure 4, and Figure 5 are already affecting water utilities' ability to serve their customers, maintain existing infrastructure, and plan for future demand and supply. Shifts in temperature and precipitation are significant factors that influence utility planning and operations. These fluctuations drive both drought stress and flooding risks within short time frames. Prolonged heat and drought conditions are likely to strain water supply, lower reservoir levels, and increase treatment costs. Additionally, more intense rainfall events heighten risks of flash flooding, infiltration and inflow, and stormwater and wastewater system overflows.

Careful planning is needed to maintain today's water supply quantity and quality. Given the climate scenarios in the 2015 Study, water demand is projected to be between 1.3% and 3.8% higher by 2050.³⁰ Yet in present day, water supply and demand are continuously impacted by factors such as population growth, development and land use change, and expanding industrial demand from sectors like data centers.

As utilities face changing temperature and precipitation patterns, as well as more frequent extreme weather events, the likelihood of water service outages and water quality challenges increases— driving up operational and treatment costs. Proactive resilience planning, however, enables faster recovery, a more efficient response to disruptions, and creates cost savings in the long run. The next section explores practical management strategies to help utilities address these challenges effectively.



³⁰ CDM Smith. (2015). Utility Climate Resiliency Study (p. ES-3). Metropolitan North Georgia Water Planning District. https://northgeorgiawater.org/wp-content/uploads/2024/01/MNGWPD_Utility-Climate-Resiliency-Study.pdf

Section 2: Recommendations for Implementing Resilience Planning

Climate change trends and extreme weather impacts, along with development and land use change, are intensifying the pressure on water utilities to prepare for weather-related events that strain critical infrastructure. The recommended strategies that follow aim to strengthen District members' resilience in the face of these events and trends across drinking water, stormwater, and wastewater service sectors. As shown in the case studies presented throughout this report, many District partners are currently implementing some of these strategies. Some of the recommendations included in this report are required by regulatory bodies, while others exceed common best management practices, but do not require exorbitant resources to implement.

Recommended strategies are derived from literature reviews, District staff expertise, and stakeholder engagement with more than 20 partners, ranging from counties, cities, and water authorities serving various sized systems and customer bases. Most emphasize preparation to help utilities manage uncertainty and avoid financial impacts on their operations and subsequently their customers. Recommendations are divided into four categories:

- ✦ [Planning for More Extreme Future Weather Conditions](#)
- ✦ [Financing Infrastructure and Sharing Resources](#)
- ✦ [Fortifying Assets](#)
- ✦ [Continuity of Operations during Extreme Weather Events](#)

Each recommendation page includes seven key attributes to help users assess feasibility and prioritize implementation within their organizations:

1. **PURPOSE** – a statement sharing why a utility might want to consider this recommendation.
2. **SECTOR** – the primary department at a water utility that would lead implementation of this recommendation.
3. **EXTREME WEATHER EVENTS** – relevant weather events, based primarily on FEMA-designated incident types for Georgia, such as floods, hurricanes, droughts, extreme heat, winter storms/extreme cold, or wind.
4. **RESPONSIBLE PARTIES** – relevant personnel that would take part in implementation, as informed by the District Water Resources Management Plan and District and stakeholder expertise.
5. **COST LEVELS** – rated low **L**, medium **M**, and high **H** based on anticipated relative costs, with planning strategies generally being less expensive than operational or capital improvements.
6. **LEVEL OF EFFORT (LOE)** – rated low **L**, medium **M**, and high **H** based on estimated staff time and complexity, as determined by District staff and stakeholder engagement.
7. **INFORMATION** **i** – calls attention to relevant supporting information such as hyperlinks, resources, or explanations.

Strategy: Planning for More Extreme Future Weather Conditions

Tactic: Design stormwater infrastructure to handle higher volumes

PURPOSE – Increasing the capacity and/or resilience of stormwater infrastructure can help mitigate the impacts of flooding, damage, and service disruptions caused by more intense and frequent storm events

SECTOR – Stormwater

EXTREME WEATHER EVENT(S) – Flood, Hurricane/
Tropical Storm

RESPONSIBLE PARTY(S) – local government/stormwater utility: stormwater manager, GIS or asset manager, engineer, planner, operation & maintenance staff



RECOMMENDED ACTIONS

- ✦ Conduct a study of local conditions that includes risk and sensitivity analyses to identify watershed areas where higher design standards are needed to increase stormwater management capacity for changing rainfall depths and future storm durations. **L L**
- ✦ Related action steps using outcomes of this type of study:
 - » Design stormwater infrastructure to manage volumes greater than the 25-year storm event or infiltrate more than 1 inch of rainfall. **M M**
 - » Upsize critical stormwater infrastructure such as outfalls, outlet/discharge pipes, chambers, or channels to accommodate greater stormwater management volumes. **H H**
 - » Expand capacity of stormwater ponds and detention basins; considerations may include raising crest elevation of dams and upsizing outlet/discharge pipes/structures to improve drain rate (when accompanying downstream analysis shows no adverse impacts to downstream property or environment). **H H**
 - » In locations with limited space, use real-time information, continuous monitoring, adaptive controls or related technologies to optimize stormwater management facilities. **M M**
 - For example: Equip a stormwater detention basin with technology that could drop weir elevation or open valves to lower water levels before or during a storm to manage higher volumes in a smaller footprint.

CASE STUDY – *Douglasville-Douglas County Water & Sewer Authority* implemented a local policy to design post-construction stormwater management infrastructure within the public right of way for a 100-year storm event, well above the standard 25-year storm event.

Tactic: Design wastewater facilities for increased storm frequency and intensity

PURPOSE – Ensure wastewater systems can handle more frequent and intense storms so they remain functional during extreme weather events and prevent overflows, backups, and service disruptions

SECTOR – Wastewater

EXTREME WEATHER EVENT(S) – Flood, Hurricane/
Tropical Storm

RESPONSIBLE PARTY(S) – local wastewater provider: operator, engineer, modeler, safety and security officer, facility manager

RECOMMENDED ACTIONS

- ◆ Perform study to determine wastewater facility capacity for changing rainfall depths and future storm durations. Develop a master plan or capital improvement plan to increase volume management capacity. **L L**
 - » For example: A facility could address capacity constraints by identifying critical points that fail to meet the new expected design storm.
- ◆ For new and expanded facilities, incorporate increased design storm depths and the related increase in inflow and infiltration (I/I) into capacity analysis. **L L**



CASE STUDY – The Metropolitan Council, the regional policy making body for the Twin Cities metro area, [*developed a policy to address I/I in wastewater conveyance systems*](#) related to climate change impacts.

- ◆ Assess and improve backflow prevention at wastewater facilities to account for higher receiving water levels. **M H**
- ◆ Where frequent sunny day peaks occur – particularly in combined systems or systems without backup power or secondary facility connections – provide additional offline influent and effluent bypasses and detention storage capacity. **H H**

Tactic: Evaluate comprehensive planning, zoning, and related land use policies to assess opportunities for heat mitigation and water volume management

PURPOSE – Prepare for increased storm depths and temperatures by coupling flood reduction strategies, stormwater infrastructure management, and temperature reducing measures with climate-informed land use policies

SECTOR – Stormwater

EXTREME WEATHER EVENT(S) – Drought, Extreme Heat, Flood

RESPONSIBLE PARTY(S) – local government: elected official, city manager, city/county attorney, utility director, city planner, plan reviewer

RECOMMENDED ACTIONS

- ✦ Evaluate and remove or revise codes and ordinances that may be obstacles to implementing green infrastructure practices such as bioretention, green roofs, or rainwater harvesting. **L L**



i Reference the [Georgia Stormwater Management Manual \(GSMM\)](#) for descriptions of green infrastructure practices and how to make your local development codes consistent with better site design principles.

- ✦ Reduce impervious surfaces by allowing greater density in current land use plans and zoning ordinances to reduce the need for stormwater management infrastructure and support greenspace preservation. **L M**
 - » Implement parking maximums instead of minimums.

i *Why do this?* Greater density reduces stormwater management volumes; consider that multiple apartments in a tower adds a smaller amount of impervious surface than if those same units were spread horizontally in low-rise buildings across a property.

- ✦ Revise vegetative planting lists for green infrastructure based on updated hardiness zones and heat and flood tolerance data. **L L**

i Find updated hardiness zones here: [USDA Plant Hardiness Zone Map](#). For other local sources of up-to-date plant expertise and available tools, consider reaching out to an Extension service connected to a local academic institution, such as UGA Extension.

- ✦ Incorporate temperature reducing strategies on impervious surfaces, which can also reduce energy costs and improve worker safety (e.g., use of lighter colored materials, installing or retrofitting grey with green infrastructure). **M M**

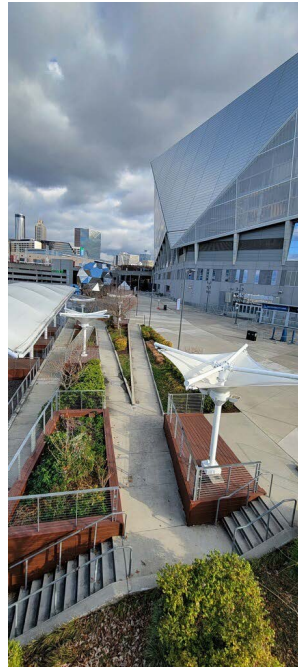
Tactic: Consider alternative water source options within the long-term master plan to augment current water supplies

PURPOSE – Reduce reliance on variable rainfall by using alternative sources like non-potable or indirect potable reuse or stormwater capture

SECTOR – Drinking Water

EXTREME WEATHER EVENT(S) – Drought, Extreme Heat

RESPONSIBLE PARTY(S) – Local water provider, with local wastewater or stormwater provider and local government as applicable: utility director, operator, engineer, data analyst, planner, department director, elected official, communications specialist



RECOMMENDED ACTIONS

- ◆ Explore and implement non-potable or indirect potable reuse systems. **H H**
- ◆ Capture and store rainwater and stormwater for non-potable uses. **H H**

CASE STUDY – *Mercedes-Benz stadium* in downtown Atlanta harvests rainwater in a 680,000-gallon cistern, which is used for both irrigating the exterior landscape and providing makeup water to the stadium’s cooling towers. While not a water utility, the stadium is a strong local example of a large scale rainwater capture system in the headwaters of a watershed (Proctor Creek to Chattahoochee River) that provides cost savings, water conservation, and community benefits.



Tactic: Incorporate recent weather and climate trends and future projections into decision-making



PURPOSE – Use recent data and modeling to guide decisions and improve reliability and resilience

SECTOR(S) – Drinking Water, Stormwater, Wastewater

EXTREME WEATHER EVENT(S) - Extreme Heat, Flood, Hurricane/Tropical Storm

RESPONSIBLE PARTY(S) – local government, water, wastewater, or stormwater provider: department director, utility manager, emergency manager, facility manager, engineer, operator, data analyst

RECOMMENDED ACTIONS

- ✦ Conduct extreme precipitation event analyses in critical areas to assess the risks to collection systems based on local experience. Differentiate between probable baseline and peak precipitation. Continue to update analysis with recent events and future projections. **M M**
- ✦ Implement climate tracking protocols (e.g., identifying long-term trusted data sources, installing monitoring instruments that are local to utility facilities). **L L**

i [USGS's gauges](#) are an example of a long-term trusted data source for monitoring creek water levels, and can be used to identify critical areas and weak points in a watershed that may need extra attention. See the District website [Water Stats](#) page for external links to data sources utilities can use to better understand and track water and weather trends.

- ✦ Monitor and model conveyance systems and modify critical infrastructure design standards to account for increased storm depth. **M M**
- ✦ Designate internal staff or external contractors to manage and calibrate water demand and distribution models within drinking water systems. **L L**

Strategy: Financing Infrastructure and Sharing Resources

Tactic: Set service rates for adaptive responses to climate impacts

PURPOSE – Provide financial resources to respond to climate impacts and invest in long-term resilience

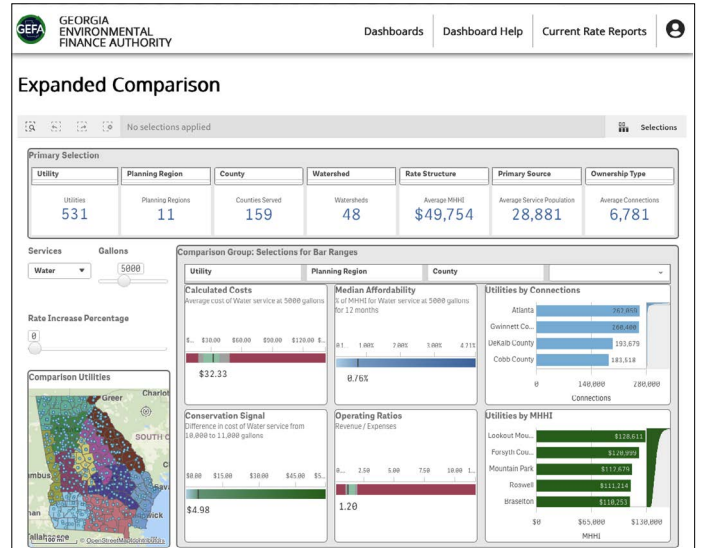
SECTOR(S) – Drinking Water, Stormwater, Wastewater

EXTREME WEATHER EVENT(S) – Drought, Extreme Heat, Flood, Hurricane/Tropical Storm

RESPONSIBLE PARTY(S) – local water, wastewater, or stormwater provider: utility director, CEO, elected official, finance personnel, city/county attorney

RECOMMENDED ACTIONS

- ◆ Implement adaptive water rates to correspond with available water supply. L M
- ◆ Define local water uses and prioritize as part of adaptive water rate considerations. L L
 - » For example: a locality might prepare a policy ahead of time that creates an emergency rate structure so that high-water-usage industries are incentivized to slow operations while carving out exceptions for hospitals and schools that often act as shelters and would see spikes in water usage at these times.
- ◆ Establish a line item in annual budget for an emergency response fund for immediate post-event response. M L
- ◆ Establish automatic, recurring incremental rate increases to allow for long-term budgeting and asset improvement planning. L L



i [Georgia Municipal Water Rates \(GEFA\)](#) Dashboard is designed to assist utility managers, local officials, and citizens in benchmarking water, sewer, and stormwater rates against various attributes.

CASE STUDIES: *Local Government – The City of Dunwoody* connects its stormwater rate structure to the municipal cost index (MCI), which is adjusted for inflation and reflects the rising costs of providing municipal services. The city council passed a resolution describing the adjustment process and reasoning behind use of the MCI. *Water Authority – Henry County Water Authority (HCWA)* billing rates, including drinking water and wastewater, are set by the HCWA Board of Directors. An automatic rate increase of 5% annually is in effect, subject to the Board’s discretion.

Tactic: Establish relationships and coordinate with neighbors to share resources during emergencies

PURPOSE – Ensure efficient response and continuity of service during emergencies through mutual aid and shared resources

SECTOR(S) – Drinking Water, Stormwater, Wastewater

EXTREME WEATHER EVENT(S) – Drought, Flood, Hurricane/Tropical Storm, Tornado/Wind, Winter Storm/Extreme Cold

RESPONSIBLE PARTY(S) – local government, water, wastewater, and stormwater provider: director, emergency manager, facility manager, asset manager, operator, operation & maintenance staff, communications specialist



RECOMMENDED ACTIONS

- ✦ Establish or revisit mutual aid agreements (written or verbal) with neighboring communities to ensure operational redundancy and source water backup during emergencies. **L M**
 - » Examples of local mutual aid agreements among water utilities include:
 - Memorandums of Understanding for monitoring, maintenance, inspection, response, or other exchange of goods or services.
 - Sending available maintenance, operation, or lab staff to neighboring cities & counties who are understaffed and experiencing an emergency event.
 - Sharing available stored equipment (e.g., valves, pipes, hydrants) to address emergencies where lead times for acquiring items would delay return of service.
- ✦ Establish or revisit procurement mechanisms that support water purchases and other mutual aid from neighboring communities in the event of an emergency. **L L**

i Refer to the US EPA's webpage on [Mutual Aid and Assistance for Drinking Water and Wastewater Utilities](#), which discusses various Water and Wastewater Agency Response Networks (WARNs) [GAWARN: Georgia Water/Wastewater Agency Response Network](#)

Strategy: Fortifying Assets

Tactic: Mitigate damage to infrastructure within flood prone areas

PURPOSE – Provide continued operation during and after intense rainfall to protect utility assets and investments from the impacts of extreme flooding

SECTOR(S) – Drinking Water, Stormwater, Wastewater

EXTREME WEATHER EVENT(S) – Flood, Hurricane/Tropical Storm

RESPONSIBLE PARTY(S) – local government, water, wastewater, and stormwater providers: elected official, director, city manager, code enforcer, plan reviewer, floodplain manager, facility manager, GIS analyst, asset manager, finance personnel, operation & maintenance staff



RECOMMENDED ACTIONS

- ✦ Identify assets at risk in flood prone areas, using digital Floodplain Insurance Rate Map (DFIRM) or local experience. **L M**
- ✦ Relocate critical components to higher ground. Alternatively, build permanent flood barriers or incorporate other design elements to maintain reliability during extreme flooding events. **H H**
 - » Examples include:
 - Set a policy to at minimum relocate generators, pumps, tanks, PLCs, chemical hoppers, and other critical or potentially polluting items out of the 100-yr floodplain.
 - Retrofit equipment and buildings with materials resistant to flood damage, as directed by a local certified floodplain manager.
 - Anchor equipment and structures to prevent floating, collapse and lateral movement, as designed by a professional engineer.

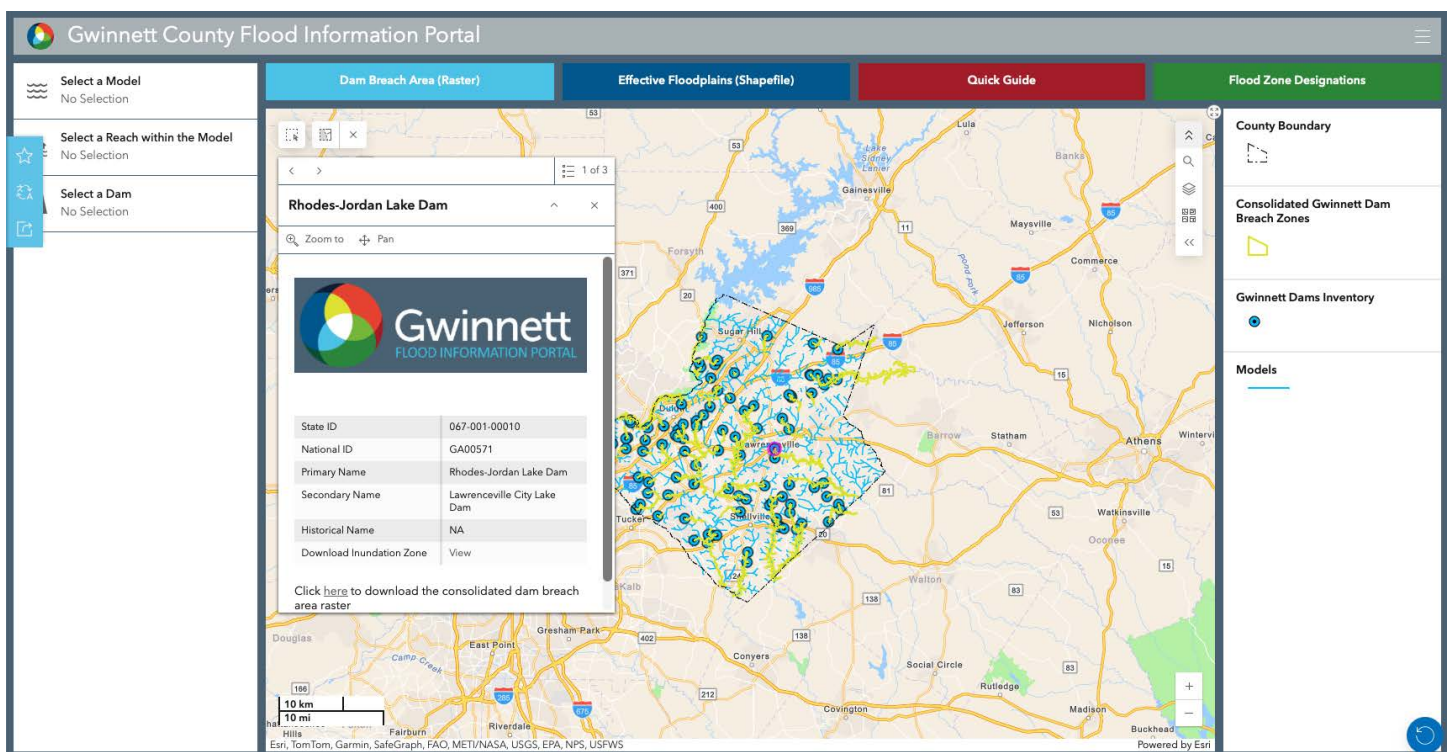
i Refer to the following for floodplain management & design guidance: FEMA [Non-Residential Floodproofing - Requirements and Certification](#); District [Floodplain Management & Floodplain Damage Prevention Model Ordinance](#); Association of State Floodplain Managers [Resource Center](#); American Society of Civil Engineers [ASCE 24-24 Flood Resistant Design and Construction](#)

- ◆ Create, update, and/or maintain future floodplain maps, including incorporating current and planned land use development and best available hydrology data. **L L**

» Examples include:

- Future planned land use data may be provided by developers in stormwater plan review submittals, or by a city or county planning & zoning department.
- Best available hydrology data may be based on international climate scenario projections, US Federal agency studies (from NOAA, USGS, or other), or local extreme precipitation event analysis (if done as part of **Tactic: Incorporate recent weather and climate trends and future projections into decision-making**).

i Note that the [District WRM Plan](#) and [District Model Floodplain Management Ordinance](#) currently define future-conditions floodplain maps as local maps developed for administering their local ordinance, separate from FEMA DFIRMs.



CASE STUDIES – Large Local Government – Gwinnett County Department of Watershed Management makes DFIRMs available [online via a flood information portal](#), at all Gwinnett County Public Libraries, and at the Storm/Water/Sewer Plan Review Section in the Department of Planning and Development building.

Water Authority – A Henry County Water Authority (HCWA) assessment identified manholes located in floodplains and undertook a program to raise them to match 100-year floodplains. The water authority also plans to decommission some lift stations in flood prone areas.

Tactic: Prioritize water supply service in an emergency



PURPOSE – Ensure continuity of essential services during emergencies by identifying critical customers and designing infrastructure with prioritized service levels

SECTOR(S) – Drinking Water

EXTREME WEATHER EVENT(S) – Drought, Extreme Heat, Fire, Flood, Hurricane/Tropical Storm, Tornado/Wind, Winter Storm/Extreme Cold

RESPONSIBLE PARTY(S) – local government, water provider: elected official, emergency manager, communications specialist, utility director, public safety officers, public health personnel

RECOMMENDED ACTIONS

- ✦ Identify the critical customers in the community such as hospitals, firehouses, and nursing homes. **L L**
- ✦ Set up designated sites for emergency supply distribution. **L L**
 - » Coordinate with the Georgia Emergency Management & Homeland Security Agency (GEMA/HS) and/or a local city or county Emergency Management Authority (EMA).
- ✦ Design and build certain critical infrastructure serving identified critical customers and emergency service locations for operation during a large range of weather events. **H H**
 - » Example: An important regional hospital that would intake people impacted by a natural disaster should have nearby pump stations with backup power sources, a purchase agreement or backup connection to a secondary water provider and transportation infrastructure elevated above flood levels to prepare for lower average recurrence interval storms up to worst case extreme storm events.

Tactic: Ensure power redundancy

PURPOSE – Ensure backup power for critical infrastructure to maintain operations during power outages caused by storms or other emergencies

SECTOR(S) – Drinking Water, Wastewater

EXTREME WEATHER EVENT(S) – Hurricane/Tropical Storm, Tornado/Wind, Winter Storm/Extreme Cold

RESPONSIBLE PARTY(S) – local wastewater and drinking water provider: operator, facility manager, asset manager, utility director, finance personnel, electrician, engineer, sustainability manager, emergency manager



RECOMMENDED ACTIONS

- ◆ Maintain redundant power requirements in accordance with Georgia EPD rules and the latest version of the District’s WRM Plan. **M M**
 - » Examples: Permanent emergency generator(s), backup power connection for portable generator(s), battery combined with local renewable source such as solar panels
- ◆ Require dual power feed at all water and wastewater treatment plants. **H H**

i To offset future high energy costs associated with operation during peak times, consider adopting [*Energy Savings Performance Contracts*](#), where the energy services company performs audits of the building, identifies potential areas for energy savings, and makes upgrades to achieve the level of energy savings specified in the contract.



- ◆ If improving power redundancy via backup generators, incorporate best practices to ensure equipment is prepared to handle the immediate need (e.g., check generator fuel weekly, have an on-call generator repair point of contact.) **M M**

- ◆ Evaluate risk of service interruption due to power loss. Ensure the level of process control (i.e., SCADA system) available to operators of water and wastewater treatment facilities match level of utility's preferred risk tolerance. **L L**
 - » Example: A drinking water utility with low risk tolerance might plan to have both manual and long-distance automated functionality on critical pipes, valves, and gates. This would allow for minimal service disruption, since on-site staff could manually operate or staff at another facility could operate from afar in a different control building if the main building loses power.



CASE STUDY – *City of Dallas* installed generators at all lift stations because of the risks posed by short-term power outages caused by fast-moving convective storms that are difficult to forecast. Additionally, the City has procured a portable generator and a hydro excavator truck for pumping and hauling, and has installed quick connections and concrete pads at each station for quick deployment of a portable bypass pump for redundancy and backup.

i [GEMA/HS's Hazard Mitigation Grant Program](#) lists examples of projects eligible for funding, including "generators that protect a critical facility."

Tactic: Retrofit existing conveyance infrastructure for long term functionality and redundancy

PURPOSE – Upgrade pipes and infrastructure to improve resilience to more extreme future weather conditions

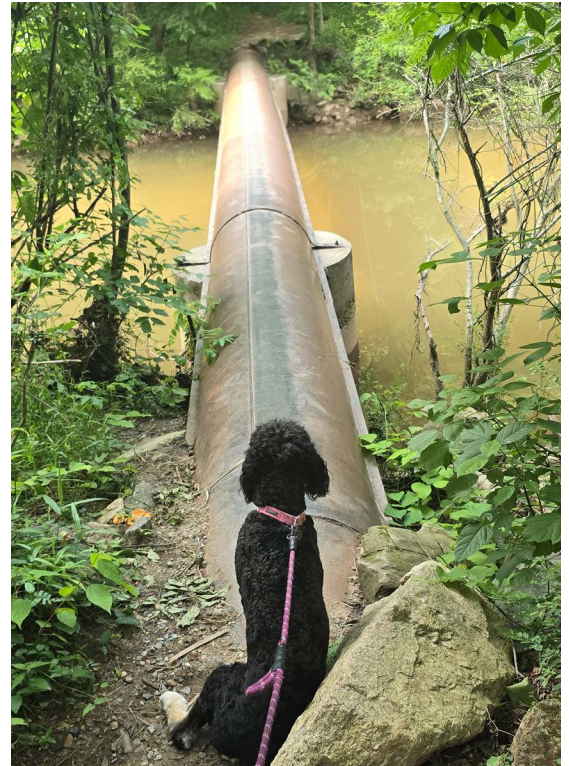
SECTOR(S) – Drinking Water, Stormwater, Wastewater

EXTREME WEATHER EVENT(S) – Drought, Flood, Hurricane/Tropical Storm, Tornado/Wind

RESPONSIBLE PARTY(S) – local water, wastewater, stormwater provider: utility director, asset manager, facility manager, engineer, modeler, operation & maintenance staff, inspector, emergency manager

RECOMMENDED ACTIONS

- ✦ Lower the elevation of source water intakes to maintain access during lower reservoir levels and reduced late-season flows under future drought conditions. **H H**
- ✦ Identify and create replacement plans for pipes and other conveyance infrastructure that are susceptible to failure from lower flow or depleted groundwater tables. **L L**
- ✦ Raise the elevation of wastewater outfalls close to stream adjacent treatment plants to avoid backup into facilities under future high intensity peak rain and flood conditions. **H H**
- ✦ Re-align or reinforce aerial sewer lines crossing streams, especially those in rapidly urbanized/developing areas experiencing flash floods and erosion. **H H**
- ✦ Implement and maintain water supply conveyance redundancy for emergencies. **H H**
 - » Examples: Larger water systems may implement alternative redundancy and reliability infrastructure elements such as multiple water treatment plants with looped distribution networks to support their demands in an emergency. Smaller water systems may build, strengthen, or maintain such connections for emergency or peak supply uses.



CASE STUDY – *Henry County Water Authority (HCWA)* has two drinking water treatment plants, both of which are capable of meeting demand for a limited period of time. The primary water treatment plant (WTP) has one primary transmission pipeline, but for additional redundancy HCWA has plans to utilize an existing feed line from the WTP and install a Venturi meter in a vault. In addition to internal redundancies, HCWA also has interconnections with, and established agreements to purchase water from neighboring DeKalb & Clayton water providers during emergencies. These agreements have been especially useful for the northern parts of the county that are further away from water resources and at higher elevations.

Tactic: Strengthen asset management & maintenance planning

PURPOSE – Plan for ongoing maintenance to ensure existing infrastructure remains adaptable to changing climate conditions

SECTOR(S) – Drinking Water, Stormwater, Wastewater

EXTREME WEATHER EVENT(S) – Extreme Heat, Flood, Hurricane/Tropical Storm, Winter Storm/Extreme Cold

RESPONSIBLE PARTY(S) – Local water, wastewater or stormwater provider: utility director, operator, asset manager, operation & maintenance staff, inspector, GIS analyst, finance personnel



RECOMMENDED ACTIONS

- ✦ Develop an adaptable monitoring and inspection program for water, wastewater, and stormwater management systems to maintain understanding of current infrastructure demand and capacity to handle more extreme weather events. (M) (M)
- ✦ Develop a program to replace assets at the end of the manufacturer's defined end of life, especially for assets effected or aged by more extreme weather events (e.g. pumps, storage tanks, gates, etc.). (M) (M)
- ✦ Monitor and inspect the integrity of existing dam infrastructure. Develop plans to upgrade and/or replace infrastructure for safety and effectiveness as conditions change. (M) (M)

CASE STUDIES – *Large local government* – *Gwinnett County Department of Water Resources (GCDWR)* is responsible for inspection and regular maintenance of 16 high-hazard dams, including 12 Natural Resources Conservation Service (NRCS) watershed dams. Before Hurricane Helene hit, GCDWR assembled a team of internal and consultant dam experts to perform inspections throughout the event. In addition to weather prediction services, GCDWR used alerts from the NRCS DamWatch system to prioritize dams that were expected to experience spillway engagement. GCDWR found it helpful to have experts familiar with the dams to assess for proper functionality and coordinate as needed with county staff and state/federal agencies such as Georgia Safe Dams and NRCS. While inspectors saw some spillways activated, there were no failures or emergency conditions resulting from the event. This proactive approach allows staff to exercise their emergency preparedness plans and potentially head off failures in future extreme weather events.

Small local government - *City of Dunwoody* monitors over 25 farm pond dams, many from the 1940s-50s. Although these structures are located on private property, city staff often field resident-reported flooding issues and coordinate with Georgia Department of Transportation (GDOT) if these issues affect right-of-way access. The city's record of dam locations and current conditions support the stormwater department's role in public safety.

Strategy: Continuity of Operations during Extreme Weather Events

The following recommendations are suggested in an effort to support more seamless operations during an emergency power outage or lapse in continuity of supply.

Tactic: Implement demand management strategies

PURPOSE – Reduce water demand and improve water system resilience through customer education and monitoring technologies

SECTOR – Drinking Water

EXTREME WEATHER EVENT(S) – Drought, Extreme Heat, Flood, Hurricane/Tropical Storm, Winter Storms/Extreme Cold

RESPONSIBLE PARTY(S) – local water provider: public education specialists, communications specialist, customer service, billing department, data analysts, utility directors, asset managers, facility managers, operators



RECOMMENDED ACTIONS

- ◆ Expand public education efforts to increase awareness of the importance of water conservation. **L L**
 - » See District website for resources aimed at educating residents, schools, and businesses to [conserve our water](#).
- ◆ Develop or increase social media presence to build trust and streamline communications in the event of an emergency. **M M**
 - » Increase presence prior to expected storms or impending drought conditions with thematic public education messaging.
- ◆ Encourage the replacement of both high-water use fixtures and appliances with high efficiency alternatives to reduce long term demands and improve overall system resilience. **L L**
 - » Incorporate energy efficiency suggestions alongside water efficiency communications to highlight the water-energy nexus, critical resource conservation, utility supply management, and cost saving potential.
- ◆ Use monitoring technology to better track demand during specific events (like droughts or major leaks discussed in [Table 2 Henry County Water Authority's experience with the 2022 Christmas Freeze](#)), identify parameters that would trigger demand management actions, and identify water conservation opportunities on both the customer and utility side of systems. **M M**
- ◆ Install and promote use of Advanced Metering Infrastructure (AMI) to help customers detect and fix leaks quickly. **H H**

Tactic: Strengthen emergency communications

PURPOSE – Ensure timely and effective coordination with key partners and maintain operational continuity during emergency events by establishing clear protocols and roles

SECTOR(S) – Drinking Water, Stormwater, Wastewater

EXTREME WEATHER EVENT(S) – Hurricane/Tropical Storm, Tornado/Wind, Winter Storm/Extreme Cold, Flood

RESPONSIBLE PARTY(S) – local government, water, wastewater, and stormwater providers: utility director, emergency manager, facility manager, public education specialist, communications specialist, data analyst, finance personnel, contract manager, operator



RECOMMENDED ACTIONS

- ✦ Maintain on-call service contracts with emergency response professionals (i.e. electricians, mechanics, engineers, inspectors) before, during, and after an emergency event. **M** **L**
- ✦ Establish direct lines of communication with the power utility, Georgia Emergency Management & Homeland Security Agency (GEMA/HS), Georgia WARN, and the National Weather Service (NWS). **L** **L**
 - » Regularly verify and update contact information, acknowledging that personnel and roles may change.
- ✦ Maintain a standing relationship with the GEMA/HS. Designate a primary and backup utility liaison to GEMA/HS. Conduct joint tabletop exercises. **L** **L**

i Reference this [US EPA Tabletop Exercise Tool for Water and Wastewater Utilities](#) to help develop tabletop exercise materials.

- ✦ Designate an internal staff member or hire an external partner/consultant responsible for writing press releases and social media posts in response to emergency conditions. **L** **L**
 - » Incorporate emergency public relations communication standards and an up to date point of contact record to utility's Emergency Preparedness Plan.

CASE STUDY – *Clayton County Water Authority's* Resiliency Manager partners with the local Emergency Management Agency and Georgia WARN to conduct training exercises with utility staff.

Tactic: Strengthen emergency operations readiness

PURPOSE – Ensure operational preparedness and continuity during extreme weather events by assigning roles, maintaining inventories, and formalizing emergency procedures

SECTOR(S) – Drinking Water, Stormwater, Wastewater

EXTREME WEATHER EVENT(S) – Flood, Hurricane/Tropical Storm, Tornado/Wind, Winter Storm/Extreme Cold

RESPONSIBLE PARTY(S) – local government, water, wastewater, and stormwater providers: emergency manager, utility director, facility manager, operator, asset manager, city planner, elected official, operation & maintenance staff, human resources



RECOMMENDED ACTIONS

- ✦ Assign personnel to test generators and fuel vehicles on a weekly basis, particularly in summer and winter months when thunderstorms, hurricanes, and freezes are more likely to result in loss of power. **L L**
- ✦ Develop a critical parts checklist and establish a regular inventory schedule to track parts available for [mutual aid](#) to neighboring jurisdictions. **L M**

i Find [Georgia WARN resource here](#). See also previous tactic: Establish relationships and coordinate with neighbors to share resources during emergencies.

- ✦ Designate an extreme weather monitoring team, gaining insight from reputable sources such as USGS, NWS, NOAA, as well as local meteorological surveys and news outlets. **L L**
- ✦ Designate hazardous weather drivers, who would also support clearing storm drains and roadways. **M M**
- ✦ Schedule and equip staff to stay overnight at larger critical operation facilities during a major weather event. **L L**
- ✦ Create emergency response communication channels, such as group texts, walkie talkies, and video calls. **L L**
 - » Train staff on extreme weather emergency communications.



Resources & Tools

To supplement the information, case studies, and recommendations in this report, tools and resources are listed here and in Appendix A. These tools provide practical guidance across various stages of resilience planning and implementation. Please note this list and Appendix A are current as of April 2026 and are subject to change. Check each external resource to determine current availability.

Available Funding for Resilience Planning

Funding opportunities such as state or federal grants and loans could help utilities build resilience to extreme weather events. Some utilities may prefer alternative approaches such as generating their own funding or savings through rate increases or other mechanisms described in [Section 2: Recommendations for Implementing Resilience Planning](#). The purpose of this section is to highlight agencies and programs that are particularly applicable or have been leveraged successfully by District utilities to improve their resilience.

State Resources

[Georgia Environmental Finance Authority \(GEFA\)](#) and [Georgia Emergency Management and Homeland Security Agency \(GEMA/HS\)](#) both offer loan and grant based financing programs to plan, design, and/or implement natural hazard resilience or mitigation projects. Some funds are allocated year-round on a rolling basis while others are provided following specific events ([such as the Hurricane Helene Resilience Funding in 2025](#)). Both state agencies have seen recent increased appropriations, and both provide technical assistance to support local governments and water utilities in successfully applying for this funding. Note that the largest GEFA financing program, Georgia Fund, does not have federal requirements for capital projects, which removes administrative complexity that can be a barrier for local jurisdictions.

Some programs can be used in conjunction with each other to receive maximum benefits for water utilities and customers. For example, GEFA funds are available to help utilities with funding planning and design, including hazard mitigation plans, which can then be leveraged in the GEMA/HS Hazard Mitigation Program Grant (HMPG) to identify eligible capital improvement projects (CIP) for funding.

Many types of water resources projects are eligible for state funding. Some are directly applicable to the resilience recommendations in this report and the adaptation strategies listed in the 2015 Study, such as:

- ◆ Green infrastructure
- ◆ Land acquisition
- ◆ Renewable energy & energy efficiency
- ◆ Correcting infiltration/inflow (I/I)
- ◆ Raw water intakes and wells
- ◆ Interconnections
- ◆ Advanced water meters (including AMI)
- ◆ Water reuse
- ◆ Source water protection
- ◆ Dams
- ◆ Reservoirs
- ◆ Communications preparedness
- ◆ Environmental or public health emergency loans up to \$1M

GEFA's [Fundable Lists](#) provide examples of previously submitted and approved projects.

District partners are implementing programs that make them competitive applicants for these funding sources. For example, at least 100 of the 112 local jurisdictions in the District participate in the National Flood Insurance Program (NFIP), and many jurisdictions have the WaterFirst designation, which means they could receive 1% interest rate reduction and additional points on their GEFA application.

Federal Resources

The Federal Emergency Management Agency ([FEMA](#)) grants award federal funding to eligible state, local, certain private non-profits, and others primarily through grants for pre- and post-emergency or disaster-related projects that support critical recovery initiatives, innovative research and other programs related to resilience. Programs that are particularly relevant to funding the recommended actions in this report include the [Preparedness Grants](#), [Hazard Mitigation Assistance Grants](#), [Emergency Food and Shelter Program](#), [National Dam Safety Program State Assistance Grant](#), and [Next Generation Warning System Grant](#).

When a city or county is directly impacted by a natural disaster, FEMA has historically allocated Category A-G [Public Assistance Grants](#) to help public utilities repair damage following the event. Even if a locality is not directly impacted by a federally declared emergency – which the District has been at least 10 times in the past decade – [Public Assistance Hazard Mitigation Funding](#) is often made available statewide. This was the case for Hurricanes Helene, Debby, and Idalia, Tropical Storms Zeta and Irma, and other severe storms and tornados in the past decade.

The U.S. Economic Development Administration (EDA) [Supplemental Grant Program](#) supports recovery efforts in areas that have experienced major disasters. Funding from their programs **can be utilized for both construction and research-oriented projects** through three specific pathways designed to facilitate recovery and **enhance the resilience of infrastructure essential for economic growth**. These projects should demonstrate clear connections to the private sector and consider workforce development implications, and applications must clearly outline the disaster's impact on business productivity. The services provided by water utilities have clear economic development throughlines, and resilient water infrastructure leads to resilient growth and workforce.

Consider the following:

- ◆ Office buildings must be vacated if they don't have water pressure to maintain fire safety standards
- ◆ Schools close if proper sanitation cannot be provided through running water in bathroom sinks and toilets
- ◆ Restaurants and hospitals alike rely on water quality to support the quality and safety of their products and services to the public



Conclusion

Rising temperatures, precipitation variability, and increasing frequency of extreme weather events have made utilities more vulnerable to operational, financial, and service disruptions—already evident in the recent hurricanes, tornadoes, droughts, and winter storms in our collective memories. But it's also evident that utilities can strengthen their resilience to climate volatility by making strategic investments in planning, emergency preparedness, operations, and infrastructure.

The recommendations offered in this report are designed to help District water, wastewater, and stormwater utilities of all sizes protect public health, safeguard critical infrastructure, and deliver reliable water services amid ongoing climate uncertainty. Success will require coordination, investment, and sustained commitment—with thoughtful planning and resource allocation, the District's water utilities will be well-equipped to meet the challenges ahead.

The evidence is clear: early investment in resilience reduces disaster impacts and lowers long-term costs. The tools and resources in this report can provide practical guidance for various stages of resilience planning.

As the region faces hotter temperatures, more intense storms, deeper droughts, and increasingly costly disasters, sustained resilience planning is not just prudent—it is essential. By planning and coordinating now, water utilities can protect their systems, evade unnecessarily exorbitant costs, and ensure reliable service for decades to come.



Appendix A – Resources & Tools

The tools and resources in this Appendix can provide practical guidance across various stages of resilience planning and implementation related to Section 2: Recommendations for Implementing Resilience Planning. Please note this list is current as of April 2026 and is subject to change. Check each external resource to determine current availability.

Foundational Resources on Climate & Resilience

These reports and assessments offer authoritative insights into observed and projected climate trends, regional vulnerabilities, and strategies for resilience planning. Consult these resources for more detailed information and broader context to the findings in this report on a global, national, and regional scale.

- ◆ **Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report - 2023** – The IPCC’s Sixth Assessment Report synthesizes the latest global climate science, highlights the intensifying impacts of climate change across sectors and regions, and considers international long-term and near-term responses.

<https://www.ipcc.ch/report/sixth-assessment-report-cycle/>
- ◆ **Fifth National Climate Assessment - 2023** – This comprehensive federal assessment, published by the U.S. Global Change Research Program (USGCRP) and coordinated by NOAA, outlines climate trends and impacts globally and across the United States. It has specific chapters on water resources, infrastructure, and public health among other topics, discusses regional vulnerabilities, and highlights adaptation strategies and policy considerations for local governments.

<https://repository.library.noaa.gov/view/noaa/61592>
- ◆ **Georgia Statewide Resilience Assessment - 2023** – This state-specific assessment conducted by the University of Georgia Institute for Resilient Infrastructure Systems (UGA IRIS) summarizes climate risks and resilience opportunities across Georgia’s communities and infrastructure systems. It includes analysis of water-related vulnerabilities such as flooding, drought, and aging infrastructure, and offers guidance for local and regional planning.

<https://iris.uga.edu/resilience-planning-for-the-state-of-georgia/>

Recommended Resources on Resilience in Water Utilities

Guidance documents from trusted sources that provide background information, best practices, and other helpful information to inform resilience planning for water utilities.

- ◆ **District Utility Climate Resiliency Study | MNGWPD** – A study to assess the potential impacts of climate variability on the region’s water resources and infrastructure. Identifies scenarios and lists recommended adaptation strategies for water utilities.

https://northgeorgiawater.org/wp-content/uploads/2015/05/MNGWPD_UTILITY-CLIMATE-RESILIENCY-STUDY.PDF

- ◆ **Local Drought Planning Guide for Metropolitan Atlanta | MNGWPD** – A guide to assist governmental public water systems in the District in understanding the EPD Drought Rule and support a coordinated, effective, and regionally consistent approach to drought response. Includes District role, pre-planning strategies, variance requests, explanation of EPD Drought Levels, reporting form template, and FAQs among other helpful content.

https://northgeorgiawater.org/wp-content/uploads/2025/11/Local_Drought_Planning_Guide_Metro_Atlanta_June2025_FINAL.pdf
- ◆ **Power Resilience Guide for Water and Wastewater Utilities | US EPA** – A guide for power source resilience at water utilities. Provides strategies, trainings, and other resources for strengthening relationships with power providers, creating on-site backup power systems and planning for long duration, widespread outages.

<https://www.epa.gov/waterresilience/power-resilience-guide-water-and-wastewater-utilities>
- ◆ **Planning for an Emergency Drinking Water Supply | US EPA** – A guide for supplying potable water during an emergency in collaboration with various partners. Includes “preplanning” tips for water supply via interconnections with neighboring water utilities, bottled water supply, and locally produced water. Also reviews roles, responsibilities, and considerations when developing an emergency drinking water plan.

https://www.epa.gov/sites/default/files/2015-03/documents/planning_for_an_emergency_drinking_water_supply.pdf
- ◆ **Flood Resilience: A Basic Guide for Water and Wastewater Utilities | US EPA** – A guide for drinking water and wastewater utilities to assess flood risks and improve resilience to flood events. Provides a four-step process for identifying vulnerable assets, evaluating impacts, selecting mitigation measures, and developing an implementation plan. Includes easy-to-use worksheets, videos, and case studies.

https://www.epa.gov/sites/default/files/2015-08/documents/flood_resilience_guide.pdf

Recommended Tools for Water Utilities

Easy to use web based, excel, or PDF tools for creating reports, thinking through planning, and prioritizing strategies.

- ◆ **Resilient Strategies Guide for Water Utilities | US EPA** – A step by step guide that drinking water, wastewater, and stormwater utilities can use to identify their planning priorities, vulnerable assets, potential strategies to implement and available funding sources for projects. Produces a customized and simple report listing these four aspects based on utility inputs.

<https://www.epa.gov/crwu/resilient-strategies-guide-water-utilities>
- ◆ **Develop and Conduct a Water Resilience Tabletop Exercise with Water Utilities | US EPA** – A web-based tool for drinking water and wastewater utilities to plan, conduct, and evaluate tabletop exercises that focus on water sector-related incidents and challenges. Provides fully customizable situation manuals and after-action reports, discussion questions, and presentation slides covering 15 all-hazards scenarios.

<https://www.epa.gov/waterresilience/develop-and-conduct-water-resilience-tabletop-exercise-water-utilities>

- ◆ **Incident Action Checklists for Water Utilities | US EPA** – A series of 12 checklists developed for drinking water and wastewater utilities to help with emergency preparedness, response and recovery activities. Topics range from source water and distribution system contamination and harmful algal blooms to natural disasters like wildfires, extreme cold and winter storms, earthquakes, drought, extreme heat, flooding, hurricanes, and tornados. Each checklist has actions and links to additional relevant EPA resources and tools.

<https://www.epa.gov/waterutilityresponse/incident-action-checklists-water-utilities>
- ◆ **U.S. Billion-Dollar Weather and Climate Disasters | NOAA NCEI** – A NOAA summarization and mapping tool by state, county, or census tract to view weather and climate hazard risk by type of disaster. Risk metrics are based on data from FEMA National Risk Index (NRI), Climate Impact Lab, CDC Social Vulnerability Index, and Census American Community Survey.

<https://www.ncei.noaa.gov/access/billions/risk>
- ◆ **Climate Ready Water Utilities (CRWU) | Adaptation Clearinghouse** – a US EPA initiative, this page of comprehensive resources is designed to provide water sector utilities (drinking water, wastewater, and stormwater) with practical tools, training, and technical assistance needed to adapt to climate change.

<https://www.adaptationclearinghouse.org/sectors/water/climate-ready-water-utilities.html>
- ◆ **Local Weather Forecast, News and Conditions | Weather Underground** – A website that provides localized weather forecasts and information from various community weather stations.

<https://www.wunderground.com>

Funding Tools & Programs

Tools and program websites providing information on various current state and federal financing options, plus decision making support on rate setting and alternatives analysis.

- ◆ **Georgia Water Rates | Georgia Environmental Finance Authority (GEFA)** – GEFA’s Georgia Water Rates reporting site is designed to assist utility managers, local officials, and citizens in benchmarking water, sewer, and stormwater rates against various attributes, including utility finances, system characteristics, customer base, socioeconomic conditions, and geography.

<https://georgiawaterrates.org/>
- ◆ **Financing Alternatives Comparison Tool (FACT) | US EPA** – A financial analysis tool that helps municipalities, utilities, and environmental organizations identify the most cost-effective method to fund a wastewater or drinking water management project.

<https://www.epa.gov/cwsrf/financing-alternatives-comparison-tool>
- ◆ **Water Programs | GEFA** – GEFA Water Programs page, updated with the latest water and sewer financing programs that provide loans for water, wastewater, sewer, reservoir and water supply, stormwater, water efficiency and conservation, and solid waste infrastructure improvements. Eligible project costs include planning, design, engineering, construction, and land acquisition.

<https://gefa.georgia.gov/water-programs>

- ◆ **Hazard Mitigation Grant Program (HMGP) | Georgia Emergency Management and Homeland Security Agency** – GEMA/HS HMGP, state administered FEMA program, advertises for applications following presidential disaster declarations and offers technical assistance to local governments for project identification and application preparation. Funding for local governments in the aftermath of a disaster for projects that reduce or eliminate the long-term risk to human life and property from the effects of natural hazards.

<https://gema.georgia.gov/hazard-mitigation-grant-program>

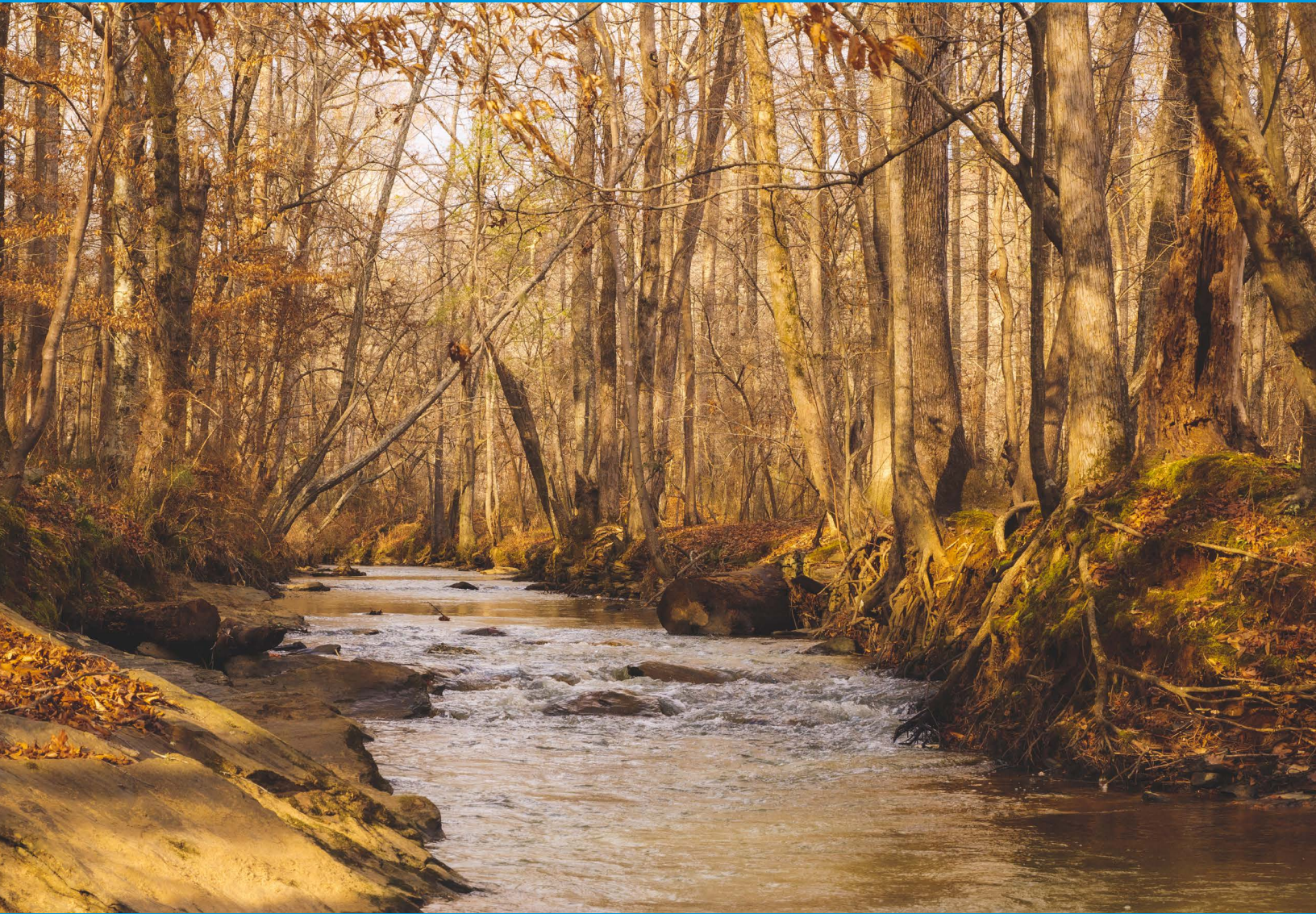
- » Examples of eligible projects: warning systems, safe room designs, retrofitting, acquisition of property, development of local standards with an implementation component, structural hazard control or protection measures such as flood walls, detention basins and other storm drainage upgrades, generators that protect a critical facility.

- ◆ **FEMA Grants | FEMA.gov** – FEMA grants are available for pre and post emergency or disaster related projects that support critical recovery initiatives, innovative research and other programs related to resilience: Preparedness grants, Hazard Mitigation Assistance Grants, Emergency Food and Shelter Program, National Dam Safety Program State Assistance Grant, and Next Generation Warning System Grant.

<https://www.fema.gov>

- ◆ **Supplemental Grant Program | U.S. Economic Development Association (EDA)** – The program supports recovery efforts in areas that have experienced major disasters, such as hurricanes, wildfires, severe storms, flooding, tornadoes, and other natural events. EDA funding can be utilized for both construction and research-oriented projects through three specific pathways designed to not only facilitate recovery but also enhance the resilience of infrastructure essential for economic growth. These projects should demonstrate clear connections to the private sector and consider workforce development implications. Applications must clearly outline the disaster’s impact on business productivity. Proposals are accepted on a rolling basis, and eligible awardees are required to provide a 20% funding match.

<https://www.eda.gov/strategic-initiatives/disaster-recovery/supplemental/2025>



NORTHGEORGIAWATER.ORG