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From Floods to Future Planning: Water Use Restriction Emergency Response Planning

Water and wastewater utilities and their partners face increasingly complex challenges in maintaining continuity of service during natural, technological, and human-caused incidents. Without effective emergency planning and regional coordination, water disruptions can cascade across other community lifelines, complicating response and prolonging recovery.

CNA, a not-for-profit analytic organization with deep experience in emergency response and supply chain analysis, helps utilities strengthen resilience through operational analysis, infrastructure and supply-chain expertise, stakeholder engagement, emergency planning, and exercises. CNA recently led the operational review of the response to Hurricane Helene by the NRV Regional Water Authority (NRV), a regional water wholesaler in Montgomery County, VA, that declared a boil water advisory in 2024 that took nearly two weeks to lift. Following the after action, CNA helped NRV develop a regional boil water response plan and tabletop exercise to help coordinate the regional partners. CNA also supports FEMA through the Supply Chain Analysis Network (SCAN), providing real-time analysis of the water systems lifeline (including outages and boil-water notices) for more than 20 past disasters—including across seven states during Hurricane Helene. Through this experience, CNA has supported every phase of water system operational resilience and emergency response planning:

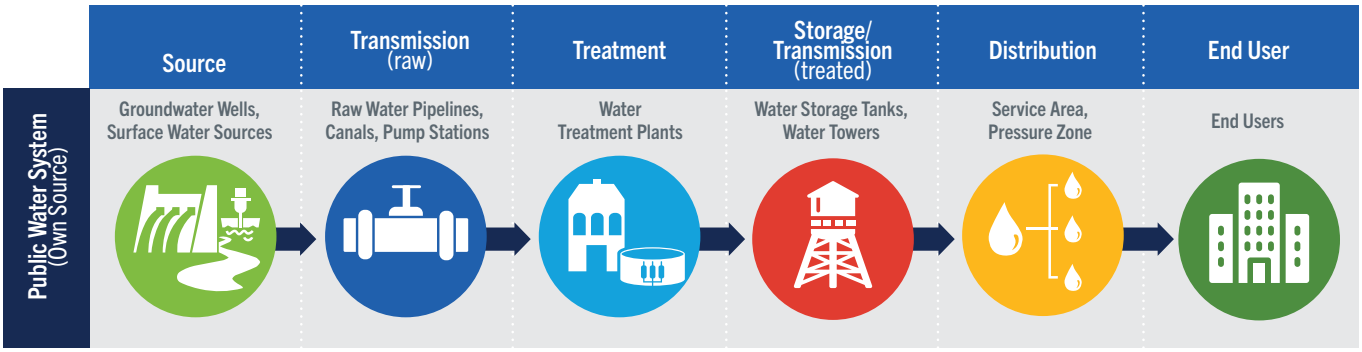
1. Assess water system baseline operational resilience and preparedness
2. Engage stakeholders and develop plans that lay out response procedures
3. Train to plans and validate them through training exercises



4. Support real-world incident responses
5. Complete after-action analysis and identify corrective actions to strengthen water system resilience

1. Assess Baseline Resilience

Water systems are complex engineered systems that are typically extremely reliable but susceptible to disruptions during major disaster events. The risk of disruption depends on many factors, including system size, source type and redundancy, treatment and pumping infrastructure, and resilience investments and capabilities including interconnections, emergency back-up generators, and mutual aid agreements. When disasters affect large areas, understanding these



factors gives context to emergency response, and lets the region plan more effectively to address potential vulnerabilities.

CNA has completed baseline resilience assessments for water systems in at least seven different regions. The assessments map and analyze water sourcing, regional water sales agreements, generators, key performance indicators (e.g., days of storage), and model hazard exposures. These assessments are often the region's first comprehensive view of water sector resilience and can lead directly into regional resilience planning.

2. Develop Plans for Water Use Restriction Emergency Responses

Clear, formal documentation and communication protocols help ensure all stakeholders receive appropriate, consistent, and timely guidance. In partnership with NRV, CNA developed the region's first *Boil Water Advisory Emergency Response Plan* for issuing and lifting BWAs.

This plan focuses on:

- Notification
- Resource coordination
- Collaboration with emergency management response partners
- Technical guidance on systems management during a water incident

Its contents are consistent with Virginia regulations and integrate with regional and local partner plans.

EXAMPLE WATER RESTRICTION RESPONSE PLAN

Detection (Hour 0)
- Test water quality
- Monitor SCADA system
- Assess staff and contractor observations
- Review customer or public reporting

Notification & Declaration (Hour 0–24)
- Notify VDH-ODW within 2 hours of detection
- Determine use restriction, in coordination with VDH-ODW
- Declare use restriction to additional response stakeholders
- Notify the public, in coordination with town/county PIOs, within 24 hours

Activation (Hour 1–24)
- Assess the scale of the incident
- Activate Water Task Force
- Notify Montgomery County Emergency Manager, if a coordinated regional response is required

Ongoing Coordination (Hour 24-Event Completion)
- Meet with response team at regular cadence
- Share updates, data, and situation reports
- Monitor resource needs and request additional resources, if needed
- Document decisions, actions, and communications

Remediation (Hour 0–Lifting Restrictions)
- Characterize containment and extent of damage
- Decontaminate system, including infrastructure repairs, system flushing, and operational adjustments
- Test water quality through sampling, laboratory analysis, and continuous monitoring
- Demonstrate compliance with water quality clearance standards

Lifting Restrictions (Remediation Completion-Event Completion)
- Update response stakeholders
- Notify the public and provide guidance on restoring normal water use

Closeout (Post-Event Completion)
- Return to standard business operations
- Complete continuous improvement activities

3. Validate Plans Through Tabletop Exercises

Conducting detailed, stakeholder-driven exercises allows agencies to test plans, clarify roles and responsibilities, and identify operational gaps in a no-fail, no-fault environment before a real crisis occurs. Successful exercises reveal how systems and partners perform under realistic stress, not just how they are intended to perform on paper. For regional water service networks with wholesalers (like the NRV Water Authority), exercises help practice stakeholder coordination between multiple water systems' staffs, local emergency managers, and state regulatory agencies.

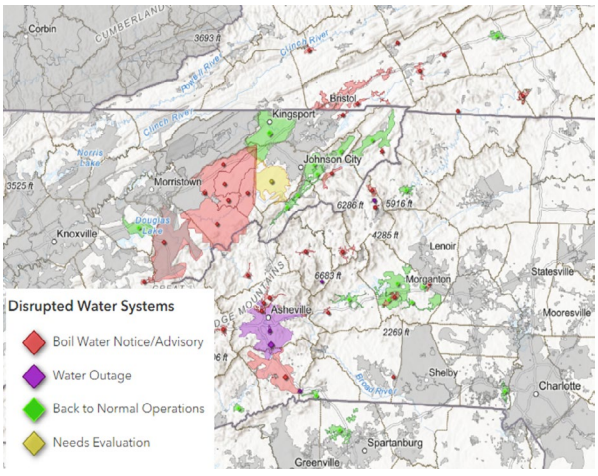
For NRV, CNA facilitated a tabletop exercise with state, local, and water authority responders to further explore a boil water advisory scenario. Participants worked through scenarios for both a chemical spill and a disruption to the supervisory control and data acquisition (SCADA) system, with a focus on detecting, responding to, and recovering from an incident necessitating water use restrictions. Ensuing discussions validated the draft planning assumptions, roles and responsibilities, and procedures outlined within the *Boil Water Advisory Emergency Response Plan*. Findings from this exercise, as well as lessons learned following the Hurricane Helene response, were incorporated into the final plan.



4. Support Incident Response With Real-Time Monitoring

Water system status affects many parts of disaster recovery, including medical facility status, accommodations and dining, industrial facility safety, school operating status, and re-entry decisions for evacuated areas. Water systems are required to communicate their operating status to customers. In Virginia, Montgomery County's public-facing boil water advisory status map was widely recognized as a best practice during their Helene incident response. However, getting a regional view of water status on a map or dashboard is often challenging for emergency managers.

CNA analysts have pioneered methods to map water system status and use restrictions in near real-time anywhere in the country. The process involves updating geospatial layers with status information collated from a wide variety of sources. During Hurricanes Helene and Milton in 2024, CNA monitored water system status across seven states in a consistent geospatial layer, updated daily. By connecting water status with geospatial data and system information, emergency managers can more quickly assess facilities that might be affected and populations that might need supplemental water.



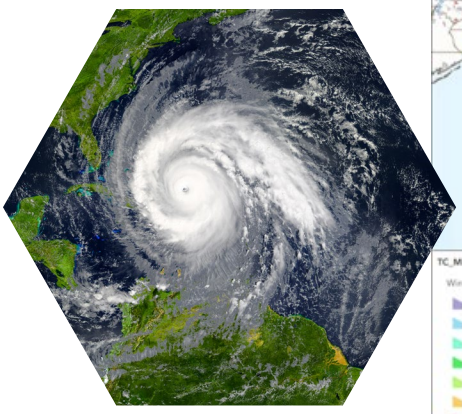
Source: CNA. Real-time Water Status Monitoring during Hurricane Helene.

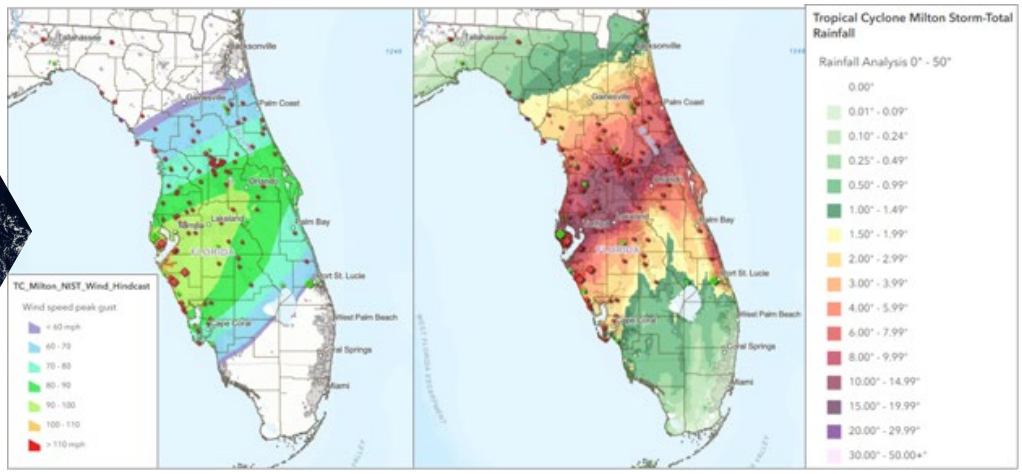
5. Complete After-Action Analyses

After-action reports (AARs) are important because they provide a disciplined, evidence-based way to capture what happened, why it happened, and how to improve performance before the next incident. High quality AARs turn observations into clear, prioritized, and actionable recommendations that drive changes in plans, training, and capabilities.

Following Hurricane Helene and the subsequent boil water advisory in Montgomery County, NRV asked CNA, which has performed more than 50 AARs across the United States, to evaluate its performance during the response. The analysis focused on communication and coordination between NRV and its system members, identifying areas for improvement for future incidents. For NRV, one critically missing capability was the absence of a regional plan to guide a response to boil water advisories and other water use restrictions. This finding started NRV's journey to strengthen water infrastructure resilience.







About CNA

The CNA Corporation (CNA) is a not-for-profit analytical organization dedicated to the safety and security of the nation. With nearly 700 scientists, analysts, and professional staff across the world, CNA's mission is to provide data-driven, innovative solutions to our nation's toughest problems. It operates the Center for Naval Analyses—the Department of the Navy's federally funded research and development center (FFRDC)—as well as the Institute for Public Research. The Center for Naval Analyses provides objective analytics to inform decision-making by military leaders and ultimately improve the lethality and effectiveness of the joint force. The Institute for Public Research leverages data analytics and innovative methods to support federal, state, and local government officials as they work to advance national and homeland security.

To learn more about water systems preparedness and response through CNA, contact Lars Hanson, Research Scientist (hansonl@cna.org) or Austen Hawk, senior project manager (hawka@cna.org).

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