# Water Infrastructure Resilience Evaluation using WNTR

Drinking water distribution systems face multiple challenges, including aging infrastructure, water quality concerns, pipe breaks, uncertainty in supply and demand, natural disasters, environmental emergencies, and targeted attacks. All of these have the potential to disrupt a large portion of a water network. Increasing resilience to these types of hazards is essential to improving water security. Simulation and analysis can help water utilities predict how their system will respond to both expected and unexpected incidents and help inform decisions to make water distribution networks more resilient over time.

The **Water Network Tool for Resilience (WNTR)** is an open source Python package designed to simulate and analyze resilience of water distribution systems. The United States Environmental Protection Agency, in partnership with Sandia National Laboratories, developed WNTR to integrate multiple critical aspects of resilience modeling for water distribution systems into a single software framework.

The software includes capability to:

- Build water network models
- Integrate GIS data into models and analysis
- Modify network structure and operations
- Assign fragility and survival curves to network components
- Model disruptive events such as power outages, earthquakes, fires, pipe breaks, and contamination incidents
- Model response and repair strategies
- Simulate hydraulics and water quality
- Evaluate resilience using a wide range of metrics
- Integrate dependency with other critical infrastructure and supply chains
- Analyze results and generate graphics

WNTR can be used to estimate infrastructure damage, evaluate preparedness strategies, prioritize response actions, and identify worst case scenarios and best practices for maintenance and operations. WNTR can be installed through the United States Environmental Protection Agency GitHub site at https://github.com/USEPA/WNTR. Documentation is available at https://usepa.github.io/WNTR/.

For more information or to conduct a case study, contact:

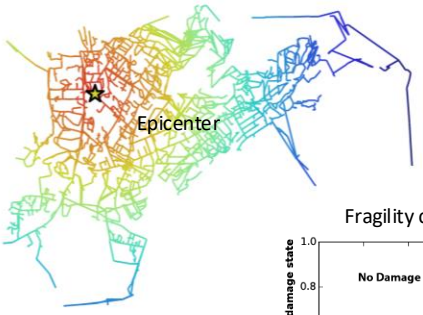
Katherine Klise, kaklise@sandia.gov
Terra Haxton, Haxton.Terra@epa.gov

WNTR
Water Network Tool for Resilience

WNTR can simulate diverse hazards to analyze water distribution system resilience

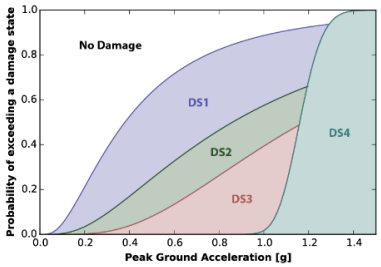
- Aging Infrastructure / Asset Management
- Power Outage and Black Sky Hazards
- Earthquakes
- Drought / Wildfires
- Water Contamination
- Flood / Hurricane
- Cyber Threats to Critical Sectors

Example application: System resilience following an earthquake

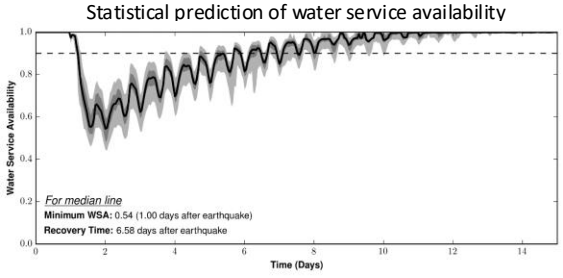



Simulated peak ground acceleration from an earthquake

Fragility curves for tank damage




Statistical prediction of water service availability

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