Case Study

Washington DC: National Capital Area

Water Resource Strategies and Information Needs in Response to Extreme Weather/Climate Events

National Capital Area

Water Trends

The Washington metropolitan region sits along the Potomac River, which provides about 90% of the region's drinking water. The topography ranges from near sea level along the Anacostia and Potomac to about 400 feet above sea level.

MWCOG reports that the region is experiencing the effects of climate change with rising sea levels and a warmer Chesapeake Bay – more than 2°C (3.6°F) in the past 70 years. NOAA climate models show that sea level rise will impact Washington, DC, and the frequency and severity of extreme events likely will increase. The region is increasingly vulnerable to tropical storms and nor'easters, heat waves, and heavy rains that cause flooding.

Drought that impacts potable water systems is far less severe here than elsewhere in the US. However, the forecasted increase in population will put additional stress on infrastructure and water resources. A recent ICPRB study estimates regional water shortages by 2040.

Governing Structures

The Washington metropolitan region has a history of well-organized regional coordination. MWCOG coordinates among local governments and utilities on a broad range of issues. The ICPRB coordinates the region's water supply. Three major water supply agencies treat about 95% of the region's drinking water: the Washington Aqueduct Division of the US Army Corps of Engineers, the Fairfax County Water Authority, and WSSC. Water is distributed by numerous utilities and local governments. The area has 19 major wastewater plants managed by 7 local governments or authorities. DC Water runs the Blue Plains Advanced Wastewater Treatment Plant, one of the largest in the country, and collects and manages wastewater from parts of Maryland and Virginia suburbs. More than 20 county and city governments manage stormwater.

The Story in Brief

Two exceptional extreme events struck the Washington metropolitan area in 2012 that provide insight into the value and cost of utility and community preparedness. With little warning, a rare derecho windstorm left a swath of wind damage in its path. Four months later and after a week of tracking and preparation, "Superstorm" Sandy devastated much of the East Coast. The Washington region was largely spared, but many lessons were learned from full-scale emergency preparation. These two events highlighted critical interdependencies between power, transportation, and water infrastructures and the need for more coordinated planning for resiliency.

The Derecho, 2012

Impacts

On June 29, 2012, a fast-moving, large, and violent thunderstorm called a derecho slammed the region with less than a day's notice, bringing with it winds upwards of 85 mph. It hit during record-high temperatures when residents used peak levels of water and power.

The June 2012 Derecho caused extensive tree damage contributing to power outages in some areas that impacted water service.

Phone systems went down or were overloaded from a combination of power outages and surges. The Washington Suburban Sanitary Commission (WSSC), seriously affected by downed power lines in its heavily treed service area, lost power at both the Potomac and Patuxent filtration plants and at more than 50 of its facilities. Water storage tanks were only at 65% capacity, since the derecho arrived before nightly recharge. Also, a large water main was out of service for repair. Together, these required water restrictions, although water service continued. Closed streets from downed trees hampered efforts to move and fuel mobile generators. On the plus side, subsequent tree trimming may have helped reduce problems when Superstorm Sandy arrived.

Emergency managers faced challenges because the derecho hit at the start of the Fourth of July holiday. While area governments were closed, relieving traffic, many responders could not commute to work as the Metro bus and rail system was disrupted by downed trees and power lines. The electric utility found that restoring power to the treatment and distribution facilities was time consuming because of extensive damage; however, the total costs of the derecho for WSSC were minor compared with the considerable cost of debris removal.

Local Government, Utility, and Community Response

Response to the derecho was mainly reactive, and utilities addressed issues as they arose. After the derecho, the DC Department of Homeland Security implemented an improved planning process with clearly defined roles and responsibilities, improved training, and began using FEMA's WebEOC to track resources and manage logistics.

WSSC benefited from facility prioritization work it had done with local power companies Pepco and BGE following a 2010 storm. Had that prior work not been done, recovery from derecho outages would have taken even longer. Following the derecho outages, Pepco and BGE agreed to further update the list of water facility priority restorations. The extensive power outages following the derecho also resurrected discussions between WSSC and surrounding counties regarding whether an onsite 10 MW generator should be built at the Potomac Water Filtration Plant. DC Water had already begun a biosolids digestor project that would use onsite combined heat and power to reduce their reliance on the electrical grid.

Superstorm Sandy, 2012

Impacts

On October 22, 2012, NOAA's National Hurricane Center issued an advisory for the 18th named tropical depression of the season. This would become the largest and second-costliest Atlantic hurricane in history. By October 24, the

A series of workshops focusing on extreme events and water resources, co-sponsored by the National Oceanic and Atmospheric Administration (NOAA), US Environmental Protection Agency (US EPA), Water Environment Research Foundation (WERF), Water Research Foundation (WaterRF), Concurrent Technologies Corporation (CTC), and NOBLIS.

NOAA EPA WERF WaterRF CTC Noblis

advisories turned into warnings for "Hurricane Sandy." Mid-Atlantic communities were on high alert, when, at 8:00 pm on October 29, Sandy made landfall as a post-tropical cyclone along the coast of southern New Jersey and her destruction began.

All this time, communities including water utilities in the Washington metropolitan area had been making full-scale preparations for hurricane-force winds, coastal and inland flooding, and blizzards. Fortunately, it skirted the service area, so Sandy had minimal effects on area water utilities, and most provided uninterrupted service through the event.

(Top) NOAA's satellite image of Superstorm Sandy. (Bottom) Workers place sandbags in advance of Superstorm Sandy to protect buildings from flooding.

Several utilities experienced short power outages and a few sewer overflows. Fairfax County suffered flooding in low-lying communities along the Occoquan River. Costs were related mostly to overtime pay for planning and maintaining "alert" status (about $500,000 at WSSC), plus the not insignificant cost of deploying backup generators. Otherwise, Sandy mostly acted as a valuable "drill" event and revealed several areas for improvement.

At the Smithsonian Institution, a direct hit would have caused some $500M in damage. Most of its buildings are on the National Mall (within a foot or so of sea level) where billions in assets are stored in basements. Since a June 2006 flood it had been working to waterproof underground spaces. During Sandy, the National Gallery of Art and American History Museum were threatened by flooding from backed-up storm drains.

Local Government, Utility, and Community Response

The Metropolitan Washington Council of Governments (MWCOG) regularly coordinates emergency preparedness calls. About 10 days before Sandy was predicted to hit, DC Water activated its own emergency management plan, which included daily calls with its trained response teams. The public information website was updated. The utility flood-proofed perimeters that were not already hardscaped and moved equipment that could be most affected. Logistics related to chemical inventory and biosolids hauling were put in place. Fairfax County, with one of the most sophisticated emergency management programs in the country, began using its multi-media citizen alert network well in advance and opened shelters. As with other jurisdictions, its flood maps are automated, but flood data were not localized enough for targeted block-by-block response (evacuating communities too frequently causes citizens to ignore warnings).

The long lead-time that kept the response community on alert for days proved exhausting. It revealed a weakness in water utility plans for staffing, including housing, provisions, and transportation; deployment, relief and stand-down schedules; and unscheduled pay. Conveying central planning decisions to field staff was challenging. Further, utilities reported that no amount of planning could stop power outages and flooding, making it critical that they manage customer expectations – and their own.

Most area water utilities conducted post-Sandy debriefs to improve emergency operations and instituted improved plans and mechanisms. However, questions remain about how to reduce the region's vulnerability to flood-inducing storms and power outages. Area planners, including the National Capital Planning Commission (NCPC), MWCOG, the Interstate Commission on the Potomac River Basin (ICPRB), and a consortium of federal facilities managers, became engaged in ongoing dialogue.

Looking Forward

Water utilities found that the pressure of short-term budget realities can conflict with the need to understand and address long-term risks. Many are investing in strategies that increase resilience. While improvements are evident in the way local jurisdictions and utilities communicate, plan, and train for emergency response, water professionals throughout the Washington metropolitan region are recognizing the need for more integrated planning among the various jurisdictions and service entities to build resilience to extreme and costly weather events. Planning and implementing this kind of approach would benefit from a public conversation to expand understanding of the various causes of flooding and service disruptions to enable them to make choices that meet near-term needs while building long-term adaptive preparedness.

To learn more about how the water sector is responding to extremes, visit:
http://www.cpo.noaa.gov/ClimatePrograms/ClimateSocietalInteractionsCSI/SARPProgram/ExtremeEventsCaseStudies.aspx

Lessons Learned

Emergency Response:

- Dependence on power is a major vulnerability (electricity and fuel).
- Supply chain plans are necessary for the number of days it takes to reach criticality, e.g., chemicals, fuel.
- No amount of after-action reporting will make up for direct experience.
- Planning for personnel provisions, communication, and transportation is critical for events with long durations.
- Public expectations must be managed and individual preparedness encouraged.

Long-Term Planning:

- Integration at a regional scale is needed given the multi-state and federal presence in the region. Multi-jurisdictional organizations are well-suited to facilitate regional planning.
- Individual leaders drive the process.
- Planners now need to consider the changing hydrology as a factor in land-use planning.
- Stormwater managers need to expand understanding and integrate effective long-term investments to achieve both water quality goals and to manage flood water.
- Limited budgets are forcing trade-offs between short- and long-term actions.

Useful Tools and Resources

- MWCOG climate change activities
- ICPRB – water supply and reliability analysis under future climate scenarios
- Georgetown University Climate Center – model language for a sea level rise overlay district for zoning
- WaterRF Climate Change Clearinghouse
- US EPA CREAT tool
- NCR WARN and the Emergency Management Systems Compact (EMAC)
- FEMA Emergency Operations Center
  - ICS training programs and drills
  - Full Spectrum Risk Knowledge Base
  - All Hazards Consortium – planning for power outage of all of NE
  - Personal preparedness iPhone app
- US EPA Emergency Training
- NOAA NWS Advanced Hydrologic Prediction Service
- FloodSmart.gov – insurance and funding information

Information Needs

- More accurate and localized flood data
- Improved projections for frequency and intensity of extreme events
- Real-time data and monitoring
- Translated river elevation data to show what river stage means
- Methods for determining long-term costs and benefits of climate-adaptation investments