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WATER /WASTEWATER AGENCY RESPONSE NETWORK

Superstorm Sandy After-Action Report

American Water Works Association

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This After-Action Report (AAR) is based on information shared by impacted utilities, state and federal partners, and the Water/Wastewater Agency Response Networks (WARNs) in New York, New Jersey, Pennsylvania, West Virginia and the National Capital Region. Supporting information for this AAR is also based on the multiple WARN coordination/ situational briefings hosted by American Water Works Association (AWWA) during the week of October 29, 2012, when Superstorm Sandy struck the Mid Atlantic and New England States.

The AAR is focused on several key observations that highlight both successes and areas that should be targeted for improvement. The pages that follow provide additional context and details related to these key observations. They will also lay out actions that can be taken to reduce consequences and increase resilience in the water sector in the future.

1. Intrastate Mutual Aid & Assistance

Success: Multiple WARNs activated to provide resources to impacted utilities as Sandy approached and passed through the eastern United States. The WARNs had already been working to increase membership and improve operational efficiency and effectiveness in sharing resources to restore systems to normal operating conditions.

Improvement: Increasing WARN membership further will allow a greater number of utilities to access resources from other utilities. Increasing WARN connectivity to local and state Emergency Operation Centers (EOCs) will ensure a more efficient and effective deployment of resources to support affected systems and reduce the burden on emergency management agencies.

Key Action: Increase participation in WARN and representation in local and state EOCs.

2. Interstate Mutual Aid & Assistance

Success: WARN and Emergency Management Assistance Compact (EMAC) have collaborated to enhance information sharing. Both systems were activated and they deployed assets in response to utility requests for assistance. WARN and EMAC exhibited excellent coordination and communications during Sandy response, building upon the recommendations of the National Infrastructure Advisory Council (NIAC). [1]

Improvement: Greater connectivity is necessary with partners in local and state EOCs to make the linkage for water sector requests that may exceed WARN/intrastate capabilities, thus requiring interstate assistance via EMAC.

Key Action: Increase awareness of EMAC's applicability in supporting water sector needs.

3. Elevating the Priority Status of Water Infrastructure

Success: Many utilities have worked with their response partners at the local, state and federal level as well as critical customers and response partners to ensure awareness exists related to the critical nature of drinking water and wastewater services, particularly public health and safety activities such as firefighting and providing safe drinking water. The recognition of this criticality, and associated response activities to support the water sector, can mitigate the impacts of cascading failures in other sectors and therefore the overall economic impact on the community.

Improvement: In some cases, there was limited recognition that drinking water and wastewater utilities represent a critical lifeline sector essential to community continuity and recovery. The cascading economic and environmental impacts of an operational issue are not well recognized, so preventive actions to mitigate risk of failure were not consistently rated high priority. This resulted in the following challenges for utilities: lack of support for backup power and fuel requests, difficulties for utility personnel trying to access their facilities to assess and/or repair damage, and a lack of coordination among response partners.

Cover photos (left to right): FEMA/Liz Roll; National Oceanic and Atmospheric Administration; courtesy of Peter Schimmel—Senior Plant Operator, Bethpage Water District

Key Action: Federal/state/local policy for emergency management must clearly elevate the water sector to top-level priority for response and recovery as recommended by the NIAC. [2] Water utilities should continue to work with their critical response partners and customers to ensure that water sector response activities are coordinated, awareness exists with regard to backup power and fuel needs, and coordination of credentialing and site access controls is done in advance.

4. Energy and Water Nexus in Disasters

Success: Many utilities have taken steps to identify their vulnerabilities to power loss and have taken preventive action, such as increasing storage capacity and utilizing backup power strategies to ensure continued operations.

Improvement: Despite these preparations, loss of power was the single greatest factor affecting water sector operations, even at utilities with backup generators. Many requests for generator and/or fuel support were either denied or not rated high priority, thus creating significant risk of cascading consequence that would impact larger community recovery efforts. The ownership status of a water system should not alter priority for response and recovery needs.

Key Action: Water sector requests for generator and fuel support must be shared with the WARN and the Emergency Support Function 3 – Public Works (ESF 3)[3] desk in the EOC. In addition, the Department of Energy (DOE) must make restoration of power to water sector assets a top priority for all power distribution providers. Utilities should continue to assess their energy management strategies to continue normal operations after a power failure. A diverse set of strategies exists for utilities that should be customized for their specific conditions.

5. Site Access

Success: Water utilities have made significant improvements in the credentialing of their own workers to ensure they can be recognized as first responders by their response partners.

Improvement: Despite these efforts at many utilities, water utility crews were denied or prevented from accessing assets that are critical to maintaining drinking water or wastewater service. Some water utility crews resorted to taking local hiking trails and/or risked violating law enforcement edicts in order to conduct necessary repairs and ensure service continuity.

Key Action: The water sector should continue to work with local, state and federal response partners to ensure water utility crews are properly recognized and allowed access to their facilities.

6. Coordination

Success: Many water systems maintain an active relationship and ongoing coordination with local, state and federal response partners through emergency planning, exercises and training.

Improvement: Inconsistent coordination, documentation and reporting of water sector issues occurred within emergency operations centers at local, state and federal levels. Also, inconsistent and piecemeal representation from state primacy agencies within state emergency operations centers strained coordination objectives for resource sharing.

Key Action: State and local emergency operations centers must establish clearly defined roles and responsibilities for water sector support. Representation can be physical or virtual, but should include a member from WARN.

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7. Situational Awareness

Success: Affected utilities attempted to assess damage and report system status along with resource needs to local, state and federal response partners.

Improvement: Assessment of utility operational status and condition must be expedited, leveraging or expanding the capability of WARN, local and state public health and environmental agencies. Limited and/or delayed reporting on operational status led to misguided and/or false assumptions regarding operational integrity. Local and regional outreach with WARN to report operational conditions was successful, and should be developed into more systematic information capture.

Key Action: Develop consistent damage assessment and system status criteria for use at the local, state and federal level in partnership with WARNs. Information requests from response partners for systems status should be connected with utility requests for resources to restore operations to support situational awareness and coordination of resources needed to repair the systems.

8. Communications

Success: Utilities recognize that critical communication systems are needed for sustaining operational integrity, response safety and coordination. When normal communications equipment and procedures are compromised, backup systems and procedures can be utilized as documented in the utilities emergency response plan.

Improvement: Impaired communication systems often have operational implications at utility level for supervisory control and data acquisition (SCADA) telemetry and response crew coordination.

Key Action: The interoperability of communication systems needs to see continued consideration based on vulnerability to service outages that can compromise operations and response effectiveness. This includes maintaining radio communication networks such as 900-MHz systems.

Intrastate Mutual Aid & Assistance

The Water/Wastewater Agency Response Networks from Florida to Maine were very active in monitoring and preparing for landfall of Superstorm Sandy. Impacts from this event were experienced by more than 690 drinking water and wastewater utilities across eleven states and Washington, DC. The WARN response included significant communications with utilities to assess operational conditions and fulfill resource requests such the following:

- *MAWARN*—West Boylston provided generator support to Northboro for sewer pump station.
- *NJWARN*—Coordination of generator needs with New Jersey Office of Emergency Managent (NJOEM) and EMAC and notice of need to surrounding WARNs of anticipated resource requests.
- *NYWARN*—Bethpage Water District provided Mill Neck Estates Water Supply with chlorination equipment via rowboat, as no other means of delivery was possible. Onondaga County Wastewater Agency provided chainsaw crew to support NYCDEP facility access. NYWARN provided informational support to the US Army Corp of Engineers (USACE), Brooklyn Joint Field Office.
- *PAWARN*—Erie Water Works responded to generator request from Lehigh County Authority within 13 minutes of request and unit was operating onsite in less than 24 hours.

Key Actions

- Increase number of utility signatories to respective WARNs through targeted outreach, support from states, and tabletop exercises.
- Increase WARN representation in local and state EOCs through targeted coordination activities and tabletop exercises.
- Increase the visibility of WARNs by promoting successful WARN activations to response partners.

Interstate Mutual Aid & Assistance

The Emergency Management Assistance Compact has been collaborating with the water sector for several years to enhance coordination and awareness with the WARN initiative.[4] During large-scale events, representatives from EMAC participate in daily WARN situation briefings hosted by AWWA. These calls provide an effective form of information sharing between WARNs and key partners, including EMAC, in anticipation of resource requests that may require interstate exchange for resource needs that may be beyond a WARN's or state resources' ability to support. This connectivity benefited the water sector in the immediate aftermath of Superstorm Sandy.

This was especially apparent in the case of New Jersey, where power-related issues were primarily handled directly by the Federal Emergency Management Agency (FEMA). It appears that, due to the total volume of requests and lack of prioritization criteria for lifeline services, water utility requests for generator support were being lost in the shuffle. In addition, requests were not consistently being posted or shared with state officials, specifically those assigned to Emergency Support Function 3. This led to significant delays that may have been prevented had there been better situational awareness. However, given the noted WARN and EMAC coordination, the EMAC staff was able to make directed inquiries regarding water sector requests for emergency generator assistance. Once discovered, multiple generator requests were fulfilled in less than 12 hours' notice. This included a WARN-driven EMAC deployment of generator assets from DC Water to support utility requests in New Jersey.

While coordination represents a positive step forward, additional connectivity is necessary with partners in local and state emergency management to expedite response to water sector requests that may exceed in-state capabilities. Additional utility knowledge of the EMAC system is needed in order to expedite the development of resource packages and cost estimates.

Key Actions

- Build state and local officials' awareness of EMAC and applicability to water sector requests.
- Improve utility awareness of EMAC system details, especially those related to the development of cost estimates for resource packages.
- Improve coordination and consolidation of water sector responsibilities under the National Response Framework (NRF).

Elevating the Priority Status of Water Infrastructure

Historically, recognition of water and wastewater utilities' role as a critical lifeline sector[5] essential to community continuity and recovery has been limited. This theme, repeated following multiple large-scale events, was finally a major stimulus for the WARN initiative following Hurricane Katrina.

While improvements have been made, understanding is limited within the emergency management community of the cascading economic and environmental impacts that can result from service disruptions in the water sector. The absence of clear prioritization criteria is then manifested in issues related to power restoration and fuel support for emergency generators, utility access to key facilities and overall coordination of community restoration efforts.

In several instances, the scale of the impact garnered significant federal support from the USACE and USEPA for several wastewater systems (Passaic Valley and Middlesex, NJ) that had sustained severe damage, resulting in a significant sewage release.[6] The resources and the type of support provided to these systems were beyond the scope that could be reasonable sustained via EMAC or WARN, in addition to the complex regulatory issues.

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In other instances, the absence of defined priorities for resource requests from drinking water and wastewater utilities—critical lifeline infrastructure—resulted in service impacts that could likely have been mitigated or avoided. For example, in Howard County, Md., despite the county executive's statement that the wastewater plant was a key facility, a loss of power resulted in 25 million gallons of raw sewage being released to a local water body. [7] A clear and recognized priority status within emergency management and the power utility may have directed greater attention to the operational need of this wastewater facility and potentially averted the environmental impacts from this spill.

A well-developed priority scheme that is supported by emergency management officials and critical lifeline sectors will help to expedite community recovery. Drinking water and wastewater services are necessary for sustaining the local economy, public health and safety, and environmental health of all communities. Action is needed to recognize this essential lifeline service to ensure or mitigate potential degradation in operations that can have significant consequences, such as evacuation of a hospital or nursing facility, closure of a public building or shelters and related fire safety issues.

Key Actions

- At the federal level, FEMA can elevate the water sector to top-level priority for response and recovery, as recommended by the NIAC,[8] and communicate this to federal, state and local emergency response managers.
- At the local level, drinking water and wastewater utilities can work to improve relationships with local emergency management agencies.[9]
- At the state level, state water agencies can work to improve relationships with state emergency management agencies.[10]
- See related actions under Energy and Water Nexus in Disasters and Coordination.

Energy and Water Nexus in Disasters

Loss of power has been the single greatest factor affecting water sector operations, even in locations with emergency generators. Multiple factors influence power reliability and a water utility's ability to cope with service disruptions. In some cases, this includes emergency generators, which are then dependent on fuel supply for long-term operations. Fuel supply for utility staff and fleet is also critical to sustaining operations. It should be noted that fuel type is also a factor; some utilities have natural gas generators, but for safety reasons that service was shut down, thus creating a need for additional emergency generator capability. Due to emergency generator equipment costs relative to required capacity and associated regulatory requirements, not all water assets have alternative power.

Specific to Superstorm Sandy, many utilities reported that they were sustaining full or limited operations with emergency generators. However, fuel resupply was beginning to reach critical levels within 4–5 days, especially in Long Island. Requests for priority on fuel delivery or generator supply were in some cases not accepted or denied if "not immediate need." This occurred in several instances, even when water service to a regional hospital was in potential jeopardy because one generator failed and a second unit required maintenance following several days of 24-hour operation. Emergency operations center personnel failed to recognize that elevating the power needs of the facility to "immediate need" would be in the best interest of the community and, more importantly, the patients served by the hospital. Supporting the maintenance of system status and preventing service from degrading should receive priority consideration in relation to systems that have already been completely compromised.

Key Actions

- Emergency management at all levels must grant high priority to water sector requests for emergency generators and/or fuel support before it becomes an "immediate need."
- The DOE can complement FEMA-led prioritization and must make restoration of power to water sector assets a top priority for all power distribution providers.
- FEMA, USACE and USEPA should collaborate and leverage the capabilities of the 249th Prime Power Battalion[11] to conduct power assessments at drinking water and wastewater facilities. This provides both the asset owner and emergency partners with important information that can expedite response efforts.
- Water and wastewater utilities should ensure they know their backup power needs and pursue diversified strategies to power their facilities.

Site Access

Water utility crews were denied or prevented from accessing assets critical to maintaining services for drinking water or wastewater service. It is common for emergency management and law enforcement agencies to permit, and often support, the restoration of access to critical facilities such as power substations. Similar support should not be denied to water utilities, as observed during Sandy and past events.

NYWARN received reports from several water utilities that their staffs were prevented from accessing key facilities by police. Due to the mission-critical nature of these assets, utility staff resorted to alternative or inventive routes in order to access plants—back roads and/or trails to bypass police barricades. This was not always the case; one water utility recruited the assistance of National Guard troops, who served as escorts for work crews. Such delays compromise a water utility's ability to sustain or recover operations that serve to protect public health and the environment under provisions of the Safe Drinking Water Act and Clean Water Act.

Following past events of similar magnitude to Sandy, many called for the application of a national credentialing system. The reality of field work and costs associated with the equipment necessary to implement a national system makes this approach unnecessarily complex. A more efficient and effective means is needed to ensure the rapid response needs of all lifeline sectors and mutual aid partners are not unnecessarily compromised. This may be as simple as recognizing the priority for response and recovery actions required to support lifeline sectors, including acceptance of utility staff identification badges for access to their assets and support for mutual aid and assistance assignments.

Key Actions

- Emergency management and law enforcement should recognize the critical nature of water service to impacted communities, and protocols should be in place to ensure access to such facilities is not denied.
- Water utility identification should be accepted for access purposes, including mutual aid partners under recognized mission assignments.
- Alternative or complementary forms of credentialing based on systems like NJOEM [12] or the Tiers of Trust [13] framework can be leveraged to support access control concerns during incident response, including mutual aid and assistance deployments.

Coordination

Inconsistent information on and reporting of water sector issues were rife within emergency operations centers at local, state and federal levels. For example, NYWARN observed critical disconnects between affected systems and the local EOCs, as well as disconnects at the state level with the Health Department and the Division of Homeland Security and Emergency Services. An example is the USACE's request to NYWARN for water sector operations status due to limited information from USEPA Region 2. Region 2 employed on-scene coordinators, normally focused on hazardous waste/oil spill issues, rather than water staff to conduct water/wastewater treatment plant damage assessments for emergency response operations during Sandy. It appears that this staffing decision resulted in water/wastewater operations being designated "low priority" for response support. This adversely impacted the water sector's ability to obtain the fuel needed to keep generators—and therefore water systems—operational. While in some cases county health departments were responsive, this appeared to vary from county to county. This was evidenced by the poor response to requests for fuel from South Huntington and Suffolk County Water Authority, compared with the strong support noted by Bethpage Water from the Nassau County Health Department.

In New Jersey, the way USEPA and the USACE were provided mission assignments by FEMA, ESF 10 and ESF 3, respectively, generated information and coordination inefficiencies. Several local municipalities indicated that they were confused about the roles assigned to USEPA and the USACE at their facilities. Closer coordination and a single FEMA tasking under the NRF would likely be an improvement over the process applied in this instance. Under the current NRF, responsibility for the water sector is spread over multiple ESF and federal agencies,[14] which introduces complexities in coordination as noted in New Jersey.

In addition, while many water utilities are operated as part of a municipality or local authority, others are privately operated. The ownership status of a water system should not alter the response and support coordination provided by local, state and federal emergency management. All water sector utilities provide a critical lifeline service to the

communities in which they operate. Therefore, technical support, coordination, and resource identification should not be withheld, given the consequences associated with disruption of service to the community at large. This was noted by several utilities in both New York and New Jersey.

Based on a national review, inconsistent representation from state primacy agencies within EOCs strained coordination objectives for resource sharing. The absence of consistent, defined roles and responsibilities for water sector support is mirrored at the local level, which compounds indecision during actual response incidents.

Key Actions

- State and local emergency operations centers must establish clearly defined roles and responsibilities for water sector support. Representation can be physical or virtual, but should include state water agency representation and a member from Water/Wastewater Agency Response Network. For example, CalWARN, in partnership with California Emergency Management, has developed an approach that could be a model for other states to enhance coordination.
- Establishing formal links and/or consolidation of federal agency roles and responsibilities for water sector issues within the NRF.

Situational Awareness

Impacted utilities attempted to assess damage and report system status along with resources needs to local, state and federal response partners.

Assessment of utility operational status and condition must be expedited, leveraging or expanding the capability of WARN, local and state public health and environmental agencies. Limited and/or delayed operational status led to misguided or false assumptions regarding operational integrity. Federal efforts should be coordinated through state emergency management to avoid multiple requests for information distracting local operators from response objectives.

West Virginia is a model example of effective and efficient information sharing and reporting. Previously gathered data was operationally relevant because it provided basic details on the cause of disruptions. In addition, this information was organized and aggregated in a manner that provided rapid assessment by key partners regarding the affected region and population. In Texas, the state works cooperatively with the TXWARN program to facilitate rapid situational awareness via automated communication systems. This has proved useful in preparation for hurricanes and more recently with drought preparation and awareness.

With the advent of various technologies that allow real-time communications, there is an expectation during disasters that information will be shared immediately. When it is not available, the water sector has observed a breakdown in the National Incident Management System (NIMS) protocols for information sharing; specifically various federal entities directly contacting utilities they suspect may be impacted. This leapfrog approach likely satisfies political/bureaucratic needs, but bypasses state/local emergency management protocols, leading to a patchwork of information that in many instances is conflicting. Per NIMS, events such as Sandy should trigger the use of the Multiagency Coordination Systems (MACS).[15]

Key Actions

- Develop consistent damage assessment and system status criteria for use at the local, state and federal level.
- All requests for information regarding utility status should be directed to state EOCs using MACS per NIMS.

Communications

Utilities recognize the importance of communication systems in sustaining operational integrity, response safety and coordination. When normal communications equipment and procedures are compromised, backup systems and procedures can be utilized as documented in a utility's emergency response plan. Many utilities operate analog or digital radio networks for operations support, service crew dispatch and general emergency purposes. It is essential that the "up net" and "down net" systems be exercised and coordinated.

Key Actions

- The interoperability of communication systems needs continued consideration, based on vulnerability to service outages that can compromise operations and response effectiveness. This includes maintaining radio communication networks, such as 900-MHz systems.

Endnotes

[1] National Infrastructure Advisory Council (2009). *Framework for Dealing with Disasters and Related Interdependencies: Final Report and Recommendations*, http://www.dhs.gov/xlibrary/assets/niac/niac_framework_dealing_with_disasters.pdf

[2] See note 1.

[3] Under the National Response Framework, the US Army Corps of Engineers is assigned as the primary agency for Emergency Support Function 3 – Public Works and Engineering, http://www.usace.army.mil/Missions/EmergencyOperations/NationalResponseFramework.aspx

[4] EMAC and WARN, http://www.emacweb.org/index.php?option=com_hdflvplayer&Itemid=285&title=EMAC-and-WARN&compid=2&id=7&page=1

[5] State, Local, Tribal, and Territorial Government Coordinating Council (2011). Landscape of State and Local Government Critical Infrastructure Resilience Activities & Recommendations. Submitted to the DHS Office of Infrastructure Protection, May 2011.

[6] NJ.com report, "Hurricane Sandy delivered a body blow to N.J. sewage plants."

[7] Fox 5 News report, "25 Million Gallons of Raw Sewage Overflows into River at Howard County Treatment Plant."

[8] See note 1.

[9] Coordination of the Water and Emergency Services Sectors: An Important Step to Better Response (EPA 817-K-12-001), http://water.epa.gov/infrastructure/watersecurity/emerplan/upload/epa817k12001.pdf

[10] Bridging the Gap: Coordination Between State Primacy Agencies and State Emergency Management Agencies (EPA 817-F-12-006), http://water.epa.gov/infrastructure/watersecurity/emerplan/upload/epa817f12006.pdf

[11] 249th Prime Power Battalion, http://www.usace.army.mil/249thengineerbattalion.aspx

[12] New Jersey Office of Emergency Management, Private Sector Essential Employee Registration Project, http://www.state.nj.us/njoem/pdf/101510_essesntialempreg.pdf

[13] Tiers of Trust, http://www.tiersoftrust.com/

[14] EPA's Support to the Water Sector Under the National Response Framework (EPA 817-F-09-011), http://www.epa.gov/safewater/watersecurity/pubs/fs_natl_response_framework_nrf_fact_sheet.pdf

[15] National Incident Management Systems (NIMS) (2008). See page 36, Figure 2. Flow of requests and assistance during large-scale events, http://www.fema.gov/pdf/emergency/nims/NIMS_core.pdf

Acronyms

AAR	After-Action Report
AWWA	American Water Works Association
DHS	US Department of Homeland Security
DOE	US Department of Energy
EMAC	Emergency Management Assistance Compact
EOC	Emergency Operations Center
ESF	Emergency Support Function
FEMA	Federal Emergency Management Agency
MACS	Multiagency Coordination Systems
MAWARN	Massachussetts Water/Wastewater Agency Response Network
NIAC	National Infrastructure Advisory Council
NIMS	National Incident Management System
NJOEM	New Jersey Office of Emergency Management
NJWARN	New Jersey Water/Wastewater Agency Response Network
NRF	National Response Framework
NYCDEP	New York City Department of Environmental Protection
NYWARN	New York Water/Wastewater Agency Response Network
PAWARN	Pennsylvania Water/Wastewater Agency Response Network
SCADA	supervisory control and data acquisition
USACE	US Army Corps of Engineers
USEPA	US Environmental Protection Agency
WARN	Water/Wastewater Agency Response Network

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For more information on WARN, go to www.NationalWARN.org

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AWWA is the authoritative resource for knowledge, information, and advocacy to improve the quality and supply of water in North America and beyond. AWWA is the largest organization of water professionals in the world. AWWA advances public health, safety and welfare by uniting the efforts of the full spectrum of the entire water community. Through our collective strength we become better stewards of water for the greatest good of the people and the environment.

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