

Incident Action Checklist – Tsunami

The actions in this checklist are divided up into three “rip & run” sections and are examples of activities that water and wastewater utilities can take to: prepare for, respond to and recover from a tsunami. For on-the-go convenience, you can also populate the “My Contacts” section with critical information that your utility may need during an incident.

Tsunami Impacts on Water and Wastewater Utilities

A tsunami is a series of water waves of extremely long length generated by undersea earthquakes, volcanic eruptions or massive undersea landslides. A large tsunami can cause local devastation, as well as damage thousands of miles away. Tsunamis can significantly impact coastal drinking water and wastewater utilities. These impacts may include, but are not limited to:

- Inundation of facilities due to high floodwaters, possibly resulting in loss of service
- Direct damage to facilities and equipment due to high velocity waves, debris and coastal erosion
- Loss of power and communication infrastructure
- Restricted access to facility due to debris, flood waters and damage to roadways
- Potential saltwater intrusion into groundwater aquifers and estuaries from high velocity waves
- Possible backflows into wastewater systems if saltwater intrudes into a wastewater outfall



EPA

The following sections outline actions water and wastewater utilities can take to prepare for, respond to and recover from a tsunami.

Example of Water Sector Impacts and Response to a Tsunami

The Great Alaskan Earthquake and Tsunami of 1964

The 1964 Alaska earthquake (also known as the Great Alaskan Earthquake, the Portage Earthquake and the Good Friday Earthquake) was a megathrust earthquake that happened on Good Friday, March 27, 1964. Across south-central Alaska, ground fissures, building collapses and coastal tsunamis resulting from the earthquake caused about 131 deaths.

Lasting nearly four minutes, the magnitude 9.2 earthquake was the most powerful earthquake ever recorded in North America, and the second largest earthquake in recorded history at the time.

In addition to liquefaction, the powerful earthquake produced ground fissures and failures which resulted in landslides and major structural damage in several communities, including damage to water and sewer mains and electrical systems in Anchorage. Post-earthquake tsunamis of up to 50 feet high destroyed several communities along Prince William Sound and Kodiak Island, and affected areas as far away as Oregon and California. In total, the tsunamis killed 119 people and caused nearly \$400 million in damages in Alaska alone.

Source: *The Watchers*, “[The Great Alaskan Earthquake 1964](#)”
 Source: University of Southern California Tsunami Research Group, “[1964 Alaskan Tsunami](#)”

My Contacts and Resources



CONTACT NAME	UTILITY/ORGANIZATION NAME	PHONE NUMBER
	Local EMA	
	State EMA	
	State Primacy Agency	
	WARN Chair	
	Power Utility	

Planning

- Incident monitoring:
 - [Tsunami Alerts](#) (National Oceanic and Atmospheric Administration [NOAA])
 - [National Tsunami Warning Center](#) (NOAA/National Weather Service [NWS])
- [TsunamiReady](#) (NOAA)
- [Recent Earthquakes: Implications for U.S. Water Utilities](#) (Water Research Foundation)
- [National Weather Service Weather Alerts](#) (NOAA)
- [Planning for an Emergency Drinking Water Supply](#) (EPA)
- [All-Hazard Consequence Management Planning for the Water Sector](#) (Water Sector Emergency Response Critical Infrastructure Partnership Advisory Council [CIPAC] Workgroup)
- [Vulnerability Self Assessment Tool \(VSAT\)](#) (EPA)
- [Tabletop Exercise Tool for Water Systems: Emergency Preparedness, Response, and Climate Resiliency](#) (EPA)
- [How to Develop a Multi-Year Training and Exercise \(T&E\) Plan](#) (EPA)
- [Make a Plan](#) (Federal Emergency Management Agency [FEMA])

Coordination

- [Water/Wastewater Agency Response Network \(WARN\)](#) (EPA)
- [Community Based Water Resiliency](#) (EPA)

Facility and Service Area

- [Oregon Earthquake Resiliency Plan](#) (see Chapter 8: Water and Wastewater Systems) (Oregon Seismic Safety Policy Advisory Commission)
- [Seismic Guidelines for Water Pipelines](#) (American Lifelines Alliance)

Power, Energy and Fuel

- [EPA Region 1 Water/Wastewater System Generator Preparedness Brochure](#) (EPA)

Documentation and Reporting

- [Federal Funding for Utilities In National Disasters \(Fed FUNDS\)](#) (EPA)

Mitigation

- [National Tsunami Mitigation Program](#) (NWS)
- [Mitigation Ideas](#) (FEMA)

Actions to Prepare for a Tsunami



Planning

- Review and update your utility's emergency response plan (ERP), and ensure all emergency contacts are current.
- Conduct briefings, training and exercises to ensure utility staff is aware of all preparedness, response and recovery procedures.
- Identify priority water customers (e.g., hospitals), obtain their contact information, map their locations and develop a plan to restore those customers first.
- Develop an emergency drinking water supply plan and establish contacts (potentially through your local emergency management agency [EMA] or mutual aid network) to discuss procedures, which may include bulk water hauling, mobile treatment units or temporary supply lines, as well as storage and distribution.
- Conduct a hazard vulnerability analysis in which you review historical records to understand the past frequency and intensity of tsunami events and how your utility may have been impacted. Consider taking actions to mitigate tsunami impacts to the utility, including those provided in the "Actions to Recover from a Tsunami: Mitigation" section.
- Complete pre-disaster activities to help apply for federal disaster funding (e.g., contact state/local officials with connections to funding, set up a system to document damage and costs, take photographs of the facility for comparison to post-damage photographs).

Coordination

- Join your state's Water/Wastewater Agency Response Network (WARN) or other local mutual aid network.
- Coordinate with WARN members and other neighboring utilities to discuss:

- Outlining response activities, roles and responsibilities and mutual aid procedures (e.g., how to request and offer assistance)
 - Conducting joint tabletop or full-scale exercises
 - Obtaining resources and assistance, such as equipment, personnel, technical support or water
 - Establishing interconnections between systems and agreements with necessary approvals to activate this alternate source. Equipment, pumping rates and demand on the water sources need to be considered and addressed in the design and operations
 - Establishing communication protocols and equipment to reduce misunderstandings during the incident
- Coordinate with other key response partners, such as your local EMA, to discuss:
 - How restoring system operations may have higher priority than establishing an alternative water source
 - Potential points of distribution for the delivery of emergency water supply (e.g., bottled water) to the public, as well as who is responsible for distributing the water
 - Understand how the local and utility emergency operations center (EOC) will be activated and what your utility may be called on to do, as well as how local emergency responders and the local EOC can support your utility during a response. If your utility has assets outside of the county EMA's jurisdiction, consider coordination or preparedness efforts that should be done in those areas.
 - Ensure credentials to allow access will be valid during an incident by checking with local law enforcement.
 - Sign up for mobile and/or email alerts from your local EMA, if available.



Communication with Customers

- Develop outreach materials to provide your customers with information they will need after a tsunami (e.g., clarification about water advisories, instructions for private well and septic system maintenance).
- Review public information protocols with local EMA and public health/primacy agencies. These protocols should include developing water advisory messages (e.g., boil water) and distributing them to customers using appropriate mechanisms, such as reverse 911.

Facility and Service Area

- Inventory and order extra equipment and supplies, as needed:
 - Motors
 - Fuses
 - Chemicals (ensure at least a two week supply)
 - Cellular phones or other wireless communications device
 - Emergency Supplies
 - Tarps/tape/rope
 - Cots/blankets
 - First aid kits
 - Foul weather gear
 - Plywood
 - Flashlights/flares
 - Sandbags (often, sand must be ordered as well)
 - Bottled water
 - Batteries
 - Non-perishable food

- Ensure communication equipment (e.g., radios, satellite phones) works and is fully charged.
- Develop a GIS map of all system components and prepare a list of coordinates for each facility.
- Document pumping requirements and storage capabilities, as well as critical treatment components and parameters.
- Establish a water-tight or offsite facility to store essential records and equipment.

Personnel

- Identify essential personnel and ensure they are trained to perform critical duties in an emergency (and possibly without communication), including the shut down and start up of the system.
- Establish communication procedures with essential and non-essential personnel. Ensure all personnel are familiar with emergency evacuation and shelter in place procedures.
- Pre-identify emergency operations and clean-up crews. Establish alternative transportation strategies if roads are impassable.
- Consider how evacuations or limited staffing due to transportation issues (potentially all utility personnel) will impact your response procedures.
- Identify possible staging areas for mutual aid crews if needed in the response, and the availability of local facilities to house the crews.
- Encourage personnel, especially those that may be on duty for extended periods of time, to develop family emergency plans.

Actions to Prepare for a Tsunami *(continued)*



Power, Energy and Fuel

- Evaluate condition of electrical panels to accept generators; inspect connections and switches.
- Document power requirements of the facility; options for doing this may include:
 - Placing a request with the US Army Corps of Engineers 249th Engineer Battalion (Prime Power): <http://www.usace.army.mil/249thEngineerBattalion.aspx>
 - Using the US Army Corps of Engineers on-line Emergency Power Facility Assessment Tool (EPFAT): <http://epfat.swf.usace.army.mil/>
- Confirm and document generator connection type, capacity load and fuel consumption. Test regularly, exercise under load and service backup generators.
- Fill fuel tanks to full capacity and ensure that you have the ability to manually pump gas in the event of a power outage. Ensure this equipment and other hazardous materials are located in a safe zone.
- Contact fuel vendors and inform them of estimated fuel volumes needed if utility is

impacted. Determine your ability to establish emergency contract provisions with vendors and your ability to transport fuel if re-fueling contractors are not available. Develop a backup fueling plan and a prioritization list of which generators to fuel in case of a fuel shortage.

- Collaborate with your local power provider and EOC to ensure that your water utility is on the critical facilities list for priority electrical power restoration, generators and emergency fuel.



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Notes:

Actions to Respond to a Tsunami



Planning

- Tsunamis often result from earthquakes; review the Earthquake Incident Action Checklist for more information on how to respond to an earthquake.

Coordination

- Notify your local EMA and state regulatory/primacy agency of system status.
- If needed, request or offer assistance (e.g., water buffalos, water sampling teams, generators) through mutual aid networks, such as WARN.
- Assign a representative of the utility to the incident command post or the community's EOC.

Communication with Customers

- Notify customers of any water advisories and consider collaborating with local media (television, radio, newspaper, etc.) to distribute the message. If emergency water is being supplied, provide information on the distribution locations.

Facility and Service Area

Overall

- Conduct damage assessments of the utility to prioritize repairs and other actions.

- Check that back-up equipment and facility systems, such as controls and pumps, are in working order, and ensure that chemical containers and feeders are intact.

Drinking Water Utilities

- Inspect the utility and service area for damage. Identify facility components (e.g., valve boxes) and fire hydrants that have been buried, are inaccessible or have been destroyed.
- Ensure pressure is maintained throughout the system and isolate those sections where it is not.
- Isolate and control leaks in water transmission and distribution piping.
- Turn off water meters at destroyed homes and buildings.
- Monitor water quality, develop a sampling plan and adjust treatment as necessary.
- Notify regulatory/primacy agency if operations and/or water quality or quantity are affected.
- Utilize pre-established emergency connections or setup temporary connections to nearby communities, as needed. Alternatively, implement plans to draw emergency water from pre-determined tanks or hydrants. Notify employees of the activated sites.

Notes:



Wastewater Utilities

- Inspect the utility and service area, including lift stations, for damage, downed trees and power availability. Inspect the sewer system for debris and assess the operational status of the mechanical bar screen. If necessary, run system in manual operation.
- Notify regulatory/primacy agency of any changes to the operations or required testing parameters.

Documentation and Reporting

- Document all damage assessments, mutual aid requests, emergency repair work, equipment used, purchases made, staff hours worked and contractors used during the response to assist in requesting reimbursement and applying for federal disaster funds. When possible, take photographs of damage at each work site (with time and date stamp). Proper documentation is critical to requesting reimbursement.
- Work with your local EMA on the required paperwork for public assistance requests.

Personnel

- Account for all personnel and provide emergency care, if needed. Caution personnel about known hazards resulting from tsunamis.
- Deploy emergency operations and clean-up crews (e.g., securing heavy equipment). Identify key access points and roads for employees to enter the utility and critical infrastructure; coordinate the need for debris clearance with local emergency management or prioritize it for employee operations.

Power, Energy and Fuel

- Use backup generators, as needed, to supply power to system components.
- Monitor and plan for additional fuel needs in advance; coordinate fuel deliveries to the generators.
- Maintain contact with electric provider for power outage duration estimates.

Example of Water Sector Impacts and Response to a Tsunami

Tohoku, Japan Earthquake and Tsunami of 2011

A magnitude 9.0 earthquake hit the northeastern part of Japan on March 11, 2011, triggering multiple tsunami events. While drinking water systems in the region suffered little to no tsunami damage, they did experience moderate to major earthquake damage. For example, earthquake liquefaction effects contributed to hundreds of broken water distribution pipes.

The tsunamis did have major effects on several wastewater treatment plants. For example, the primary treatment plant of the Miyagi Prefecture was impacted by two tsunamis. The first caused little damage because most facility components were constructed at a height above the 5 meter wave. The second tsunami, however, was approximately 10-15 meters high and eroded building structural foundations, overtopped treatment tanks, destroyed electrical controls and wiped out power supplies and emergency generators.

*Source: American Society of Civil Engineers and Technical Council on Lifeline Earthquake Engineering
"Report on the 11 March 2011 9.0 Tohoku, Japan Earthquake and Tsunami"*

Actions to Recover from a Tsunami



Coordination

- Continue work with response partners to obtain funding, equipment, etc.

Communication with Customers

- Assign a utility representative to continue to communicate with customers concerning a timeline for recovery and other pertinent information.

Facility and Service Area

- Complete damage assessments.
- Complete permanent repairs, replace depleted supplies and return to normal service.



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Documentation and Reporting

- Compile damage assessment forms and cost documentation into a single report to facilitate the sharing of information and the completion of state and federal funding applications. Visit EPA's web-based tool, Federal Funding for Utilities—Water/Wastewater—in National Disasters (Fed FUNDS), for tailored information and application forms for various federal disaster funding programs: <http://water.epa.gov/infrastructure/watersecurity/funding/fedfunds/>
- Develop a lessons learned document and/or an after action report to keep a record of your response activities. Update your vulnerability assessment, ERP and contingency plans.
- Revise budget and asset management plans to address increased costs from response-related activities.

Mitigation

- Identify mitigation and long-term adaptation measures that can prevent damage and increase utility resilience. Consider impacts related to earthquakes when planning for system upgrades (e.g., replacing pipes, wellheads and water tanks to address seismic weaknesses).

Notes: