

WILL THERE BE WATER AFTER AN EARTHQUAKE?

Sonoma County Residents Face Big Challenges

SUMMARY

When the next earthquake arrives, will we have enough water? Engineers say our water supplies will probably be disrupted after a major earthquake. In Sonoma County, most people rely on water supplied by Sonoma Water (formerly known as the Sonoma County Water Agency) to nine city contractors and special districts, and they, in turn, deliver water to residents, businesses, and organizations within their areas. The Sonoma County Civil Grand Jury has investigated how well-prepared Sonoma Water is to respond to a major earthquake. Our report seeks to answer this crucial question: What plans and resources are in place in the event of a major earthquake, to provide drinking water to residents of the county who receive water from Sonoma Water?

The Russian River is the primary source of water for Sonoma County and northern Marin County. Sonoma Water supplies 90% of the pressurized water used in nine contracting cities and water agencies (Santa Rosa, Windsor, Cotati, Rohnert Park, Petaluma, City of Sonoma, Valley of the Moon Water District, Marin Municipal Water District, North Marin Water District) that together serve over 600,000 customers. Water flows through a network of pumps, pipes, and valves to its final destination in our homes, hospitals, schools, and businesses.

Sonoma Water projects that a minor earthquake (5.0 or less) will not impair water supply operations or services, and will not present immediate danger to the health and welfare of the public. However, in 1969 an earthquake of similar intensity along the Healdsburg fault destroyed 101 structures. Further development and expanded population since then suggest that damage would be more severe if the same jolt were to hit us today. Most certainly, a stronger earthquake here or nearby is likely to impair water operations and services, impacting both the public and the agency's employees. Quakes of this size are felt by most people, and damage could be extensive.

Consequences anticipated from a major earthquake include:

- Fires
- Power failures
- Building/structure damage
- Water and wastewater leaks/spills/interruption of service or quality
- Impassable roads
- Congested telephone and cell service
- Injuries and Deaths

Sonoma Water estimates that after an earthquake of magnitude 7.0 or higher, damage to their aqueduct and/or pumping stations could be restored within 3 days to 2 weeks. However, this estimate depends on the availability of equipment and crews, and will vary with earthquake severity and location. During repairs to the piped system, stored water from various tanks and reservoirs may provide water for approximately 36 hours. City contractors will activate pumps

from local ground water wells to maintain tank levels, attempting to sustain the water flow and keep the system pressurized, but these sources do not have sufficient capacity to satisfy the full system demand.

In 2008, Sonoma Water conducted a natural hazard assessment which led to a Local Hazard Mitigation Plan (LHMP). Sonoma Water prepared the plan to secure water supply facilities, and to seek funding from federal and state agencies to help pay for upgrades. The plan has been updated several times since then. The main thrust of that plan was the seismic upgrading of the Santa Rosa Aqueduct, the pipeline originating at pumped wells along the Russian River.

In anticipation of breaks due to seismic activity, Sonoma Water has installed a series of isolation valves that enable the flow of water to be cut off and rerouted, contributing to the resiliency embedded in the system. Seismic stabilization columns have been inserted into the riverbank soil adjacent to wells in order to mitigate liquefaction (the phenomenon that causes soil to lose strength and stiffness). Further system improvements are anticipated as funding is made available.

Sonoma Water has developed a priority transmission plan to “triage” the delivery of water after a powerful quake. Using a guiding principal of public safety and fire suppression, the agency would:

- Notify water contractors
- Give public notice
- Isolate water losses
- Maintain water pressure
- Prioritize crew response
- Employ mutual aid and equipment from other water agencies as needed
- Maintain power with PG&E and/or generators
- Provide flow using water storage tanks, reservoirs, and rerouted flows

The Sonoma County Civil Grand Jury acknowledges the research, effort and time that various entities within the county have put towards the formation, implementation, and ongoing evaluation of preparedness plans. The Grand Jury recommends that Sonoma Water implement the highest priority mitigation measures; improve coordination and training with other water districts; and educate water users on their risks and individual responsibilities for earthquake preparedness. We recommend continuing research, improvement, and attentiveness to earthquake preparedness by Sonoma Water, city water contractors, private districts, and residential households.

BACKGROUND

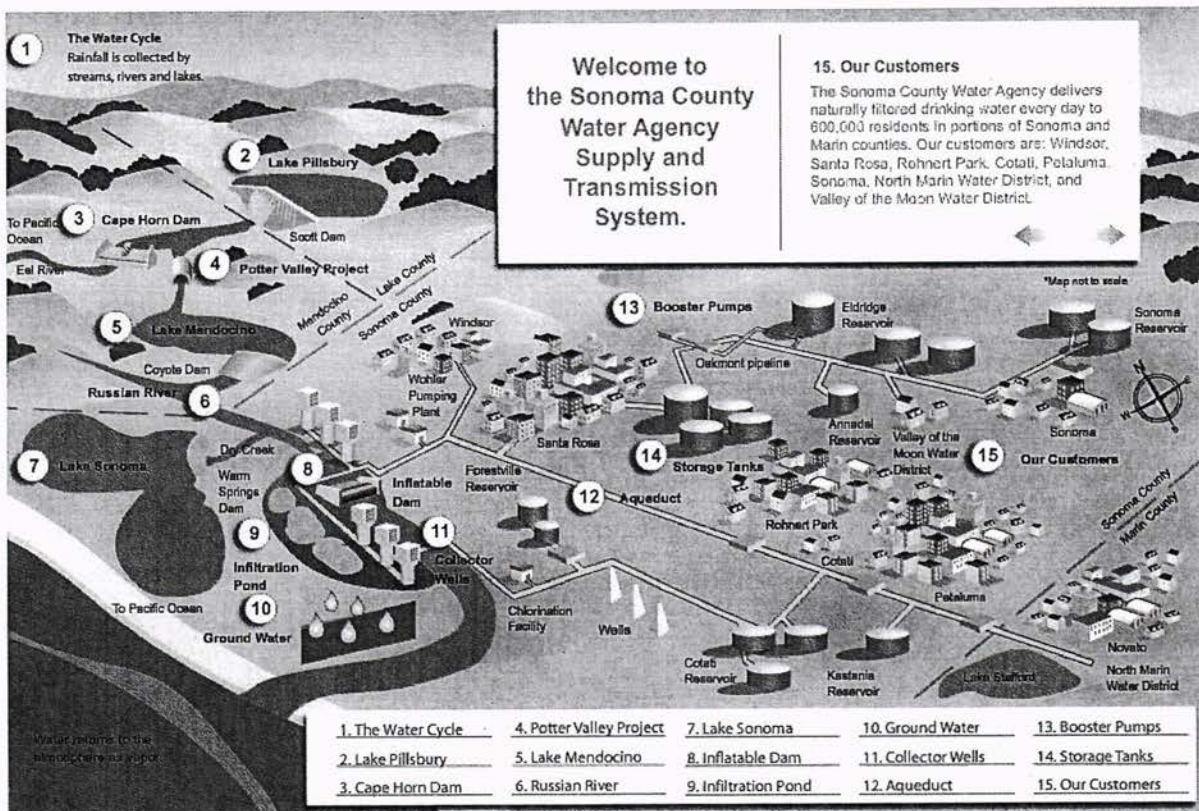
The Sonoma County Civil Grand Jury has investigated the risk of a major earthquake in Sonoma County and the effect that it could have on residents, due to impacts on water supplies. Sonoma County is located in an area subject to multiple natural hazards. Historically, we have been impacted by floods, wildfires, landslides mudflows, and earthquakes. Due to our proximity to

the San Andreas and other faults, our county has a high earthquake risk. A detailed map of earthquake faults and areas of liquefaction is searchable at sonomacounty.ca.gov.

Although many Sonoma County residents live outside urban areas and rely on water from private wells, even more people depend on water from the Russian River. Sonoma Water operates and sustains the water transmission system. The mission of Sonoma Water is to “effectively manage the water resources in our care for the benefit of people and the environment through resource and environmental stewardship, technical innovation, and responsible fiscal management.”

Sonoma Water’s supply system is made up of transmission pipelines (aqueducts), collector wells, booster pump stations, storage tank reservoirs, an inflatable dam, and other facilities that allow the agency to supply water for drinking and firefighting, manage flood risk, and maintain health and key watersheds. The agency also manages two major reservoirs which store water behind dams owned by the Army Corps of Engineers.

The Sonoma Water system contains 108 miles of mainline pipe and 18 water storage locations, all of which need ongoing maintenance. Day-to-day operations supply contractors at any flow rate they demand up to the contract limit. System pumping rates under normal conditions typically range from 49 to 69 mgd (million gallons per day). Operations are standardized at 60-110 pounds per square inch pressure, using booster pumps as needed.



(Source: Sonoma Water)

In 2000, the federal government enacted the Disaster Mitigation Act which incorporated earlier disaster legislation. The Act was a precursor to the current Federal Emergency Management Agency (FEMA). In addition to assistance when emergencies occur, the legislation supports pre-disaster planning and hazard mitigation. FEMA requires a Local Hazard Mitigation Plan (LHMP) to qualify for pre-disaster mitigation grant funds. Sonoma Water's first LHMP was developed in 2008. As a foundation for that, the County developed a Natural Hazard Reliability Assessment. Since 2008, Sonoma Water has updated the LHMP to address the various risks, first in 2013 and again in 2018.

Sonoma Water is carrying out plans to decrease the vulnerability of the water system to earthquakes and other hazards, and to remain operable after an earthquake. The location, intensity and timing of an earthquake cannot be predicted, but the risks can be estimated. Earthquakes are a recurring event in our county. Some earthquakes cause extensive damage while others do little harm. The factors that determine how destructive an earthquake can be include: location, magnitude, depth, and distance from the epicenter, local geological conditions, secondary effects, and architecture. Examples of secondary effects are: In the event of an earthquake with soil liquefaction, landslides could occur and cause damage to adjacent structures. If the quake occurred in the middle of a populated area, a low magnitude quake with a shallow epicenter could still cause moderate damage.

Critical components of the water system include collector wells, aqueducts, and storage tanks. Damaged water pipelines could drain the system rapidly causing water shortages. Facilities most likely to be affected significantly are those within the Rodgers Creek Fault zone. That fault cuts across the Santa Rosa aqueduct and could significantly impact those water systems. Additionally, the Bennett Valley fault crosses the aqueduct that goes to Sonoma and the Oakmont pipeline.

How significant the impacts of a major earthquake are to our water supply depends on how rapidly the water systems can be repaired. In the event of a major earthquake, some or all of the people in Sonoma County could be faced with poor water quality and with water shortages ranging from brief interruptions and rationing, to complete curtailment for extended periods. Good preparations can lessen the destruction and loss of life that often go with similar events.

Sonoma Water: Its Background, Responsibilities, and Significance

Sonoma Water was established in 1949 by the California Legislature as a special district called the Sonoma County Water Agency, to provide flood protection and water supply services. It is a separate legal entity created under California law, having specific limited purposes and powers and separate sources of funding. Legislation enacted in 1995 added the treatment and disposal of wastewater to the agency's responsibilities. The Sonoma County Board of Supervisors serves as the agency's Board of Directors.

Sonoma Water maintains a water transmission system that provides naturally filtered Russian River water to more than 600,000 residents in Sonoma County and portions of Marin County. The Agency, a water wholesaler, sells potable water primarily to nine cities and special districts that in turn sell drinking water to their residents. These contactors are: the cities of Santa Rosa,

Rohnert Park, Cotati, Petaluma, Sonoma, and the town of Windsor, Valley of the Moon Water District, Marin Municipal Water District, and North Marin Water District.

Recommendations for protecting the water supplies in the event of an earthquake are consistently among the highest priorities in the hazard mitigation plans for both Sonoma Water and the utilities that deliver water to consumers. The Grand Jury assessed the priorities and evaluated how rapidly progress is being made, and what options exist for reducing the risks more rapidly.

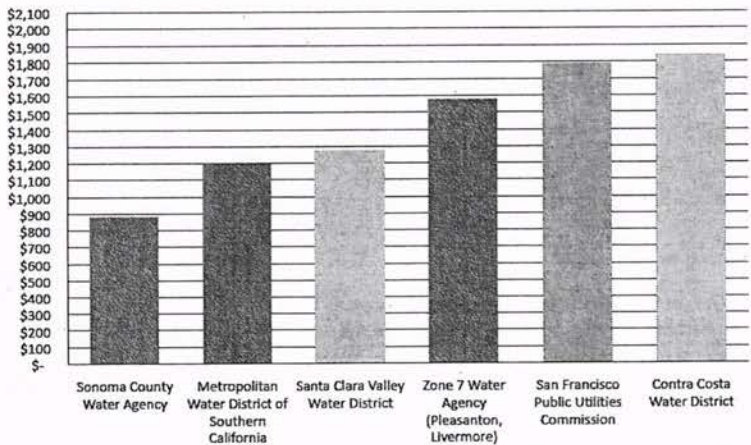
Funding for Hazard Mitigation

A FEMA-approved Local Hazard Mitigation Plan is required to apply for federal hazard mitigation funding from FEMA, and it must be updated every 5 years. Sonoma Water has updated its LHMP every 5 years since 2008, most recently in 2013 and again in early 2018 when it was submitted to Cal-OES and FEMA. Meeting the FEMA deadlines has made the agency eligible for federal grants.

Sonoma Water has an annual Capital Projects Plan (CPP) to accomplish mitigation actions, programmed work and necessary maintenance. As mitigation actions are achieved, the implementation schedule and planning budget estimates for the next tier of actions are

developed. When considering funding sources, currently Sonoma Water has one of the lower rates in California.

2018 Wholesale Water Rates Per Acre-Foot



Sonoma Water FY 18-19
Proposed Budget and Rates:

Presentation to the City of Sonoma

Adoption and updating the LHMP has been successful: Substantial grant funds have been applied to seismic improvements for the water system. Twelve funding agencies and numerous grant programs are listed in their LHMP 2018 report. Sonoma Water continues to identify external funding sources for further mitigation.

METHODOLOGY

The Sonoma County Civil Grand Jury conducted the following investigations:

- Interviewed and observed staff members of Sonoma Water and staff from several water contractors.
- Reviewed Sonoma Water's website, documents from their website, their 2018 Local Hazard Mitigation Plan, and their EOP (Emergency Operations Plan); the City of Santa Rosa's 2017 Local Hazard Mitigation Plan, web information, and EOP; and the City of Sonoma's web information, water division information on the web site, and their EOP.
- Read multiple references on earthquakes and water issues.
- Toured Sonoma Water's multiple storage yards, Santa Rosa City water storage yard, and City of Sonoma water storage yard.
- Observed collector wells, pumps, inflatable dam, booster station, storage tanks, SCADA communications, switchyard, emergency generators, chlorination facility, and pH adjustment facility.

DISCUSSION

This investigation used several projections and scenarios to aid in analyzing the preparedness of the water systems in Sonoma County. In Northern California, earthquakes occur frequently. Most are below 2.0 on the Richter scale and pose no danger to the public and life supporting infrastructures. Larger earthquakes have occurred in the Bay Area. The Napa quake in 2014 was 6.0, the Loma Prieta quake in 1989 was 6.9, the Santa Rosa quake in 1969 was 5.7, and the 1906 San Francisco quake was 7.8.

Over 600,000 people in Sonoma and Marin Counties receive water from the Russian River system, delivered through Sonoma Water and local water utilities. Some local water systems supplement the Russian River water with water pumped from underground aquifers. None of these water systems has sufficient underground water supply capacity to meet its regular local water demand without the Russian River supply. Examination of earthquake and repair scenarios indicate that water supply interruptions in some areas could be significantly longer than three days, and local reserves could be depleted by then.

Imagine the following scenario: At 2 o'clock in the morning tomorrow, a 7+ earthquake occurs on the Rogers Creek fault. The epicenter is near Glen Ellen, California. The quake causes a lateral motion that breaks the aqueduct's main pipe, leaving a complete offset of the pipe. At the break, the full volume of the aqueduct's water is released. Due to the offset, multiple sections of the pipe are damaged; water quickly erodes the soil surrounding the pipe. The pipe is at the Eldridge pump station and the water release has moved the pumps and housing structures from their foundations. The pump station damage causes the main PG&E circuit breaker to switch

off. No outside help can be expected; the water districts for San Francisco and the East Bay have called in all their employees to evaluate their own water systems.

Sonoma Water would mobilize staff to assess damage throughout the county. Isolation valves could be closed to stop the loss of water flows at the break sites. Ground water pumps could be initiated to maintain tank storage levels, thus supplying continued pressure to viable pipelines for fire suppression and public safety. If a section of pipe is unusable, above ground hoses can be attached into a viable section to run the water flow above ground. Mobile water treatment units could be brought into service to provide some relief, while local contractors may be asked to supply bottled water. Sonoma Water employees are mandated emergency responders, however some live outside the service area and may not be able to respond immediately.

Vulnerabilities to the Sonoma Water infrastructure are known and have been prioritized. The California Emergency Services Act requires urban water agencies (which track and shape state and federal water policy) to provide a catastrophic supply interruption plan. Sonoma Water, under the Act, developed its EOP. "The EOP outlines standard operating procedures (SOPs) for all levels of emergencies, from minor to major disasters and are coordinated with the water contractors EOPs". (California Urban Water Management Plan, 2015)

The Civil Grand Jury has found that not all Sonoma Water contractors have EOPs and none have specific SOPs. Sonoma Water has their own EOP and some SOPs. The Grand Jury is recommending that Sonoma Water and its contractors coordinate their EOPs and SOPs for all water interruption events. The SOPs should be updated annually or whenever there are changes to procedures and updated logs should be included in the SOPs. The SOPs should be available 24/7/365 to Sonoma Water and all contractors and should contain:

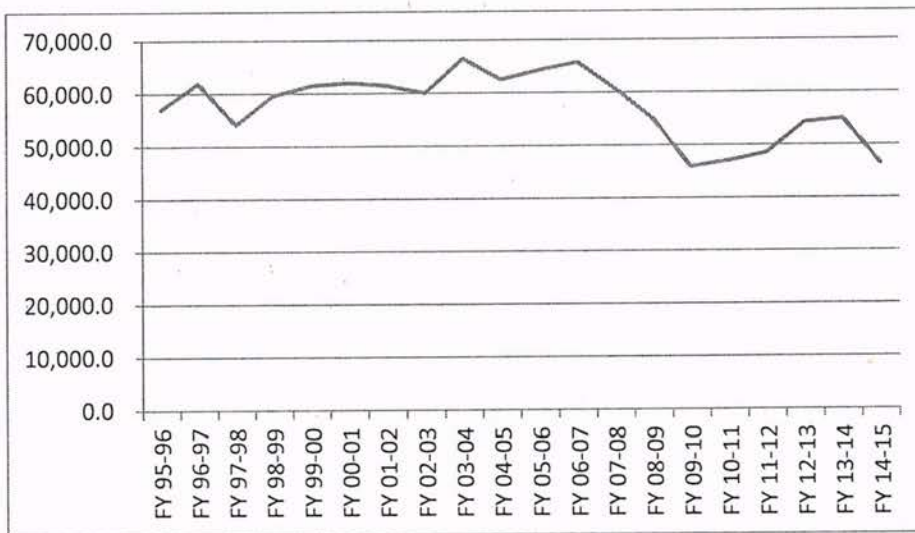
- Contact information
- A list of supplies
- Locations of supplies
- Outside Mutual Aid resources
- SOPs available on a website, in manuals, and in emergency vehicles

Over the last decade there have been efforts to move Emergency Management Planning away from addressing individual disasters towards an All-Hazard Management plan. The All-Hazard model takes a task and breaks it down into an emergency plan in which all employees follow a standard protocol. On reviewing this plan with Sonoma Water's emergency plans, the goal is to have current utilities incorporate the All-Hazard concepts into their existing emergency preparedness. The All-Hazards model does not focus on the incidents that cause the problems, it focuses on addressing the consequences, such as loss of power. As the concepts are new and not yet fully implemented, the Grand Jury believes that Sonoma Water should continue their current approach in progress, to disasters, including the above recommendations, and continue to evaluate the newer All-Hazard consequences Model while retaining its current approach.

Technical Data

Sonoma Water is authorized to withdraw up to 75,000 acre-feet of water from the Russian River annually. In recent years, the water volume actually withdrawn has been considerably less, with per capita consumption of water declining in response to public relations efforts and citizen cooperation to conserve. In fiscal year 2015-16, for example, reported water deliveries for the year were 39,905 acre-feet. With population growth, more water and more conservation may both be necessary in the future. In anticipation of future demands, the district has acquired upstream access along the river where other extraction wells could be installed adjacent to the river.

acre foot of water – the volume of water necessary to cover one acre of surface area to a depth of one foot. Equal to 43,560 cubic feet, or 325,851 gallons.



Water Delivered by Sonoma Water, acre-feet per year
(Source: Sonoma Water)

The extraction wells filter the supply, avoiding intake water treatment other than preventive chlorination. These Ranney type wells extract water from the aquifer with direct connection to a surface water source, in this case the Russian River ([https://en.wikipedia.org/wiki/Ranney collector](https://en.wikipedia.org/wiki/Ranney_collector)). The wells are housed in three caissons at Wohler Bridge and three at Mirabel. Each caisson houses two matched turbine pumps. The combined pumping capacity of wells at Wohler Bridge and Mirabel exceeds system requirements, providing redundant capacity for normal servicing and emergency events.

Power is purchased from PG&E and delivered at 60kV (kilovolts) to the water district's switchyard where it is stepped down for pumping and other electrical uses at Wohler Bridge and Mirabel.

During peak water use in the summer, the wells at Mirabel could draw down too much water if operating alone. The solution is an inflated rubber dam that allows water to be pumped to adjacent spreading basins, where it filters back into the Ranney wells.

Water storage tanks in strategic locations along the aqueduct and contracting communities are used to balance system flows, sustain system pressures, and provide backup supplies for emergencies. Tank maintenance (re-coating) throughout the system is about three years behind the optimal schedule. Re-coating takes the tanks out of service for an extended period up to a year, reducing storage capacity.

Local Hazard Mitigation Projects

Beginning with the first LHMP in 2008, Sonoma Water has participated in successive hazard mitigation efforts which are cited as contributing to a stronger water supply system. By 2012, several projects had already been completed. To date, Sonoma Water has completed more than 32 projects ranging in cost from \$71,000 to 12.7 million dollars.

Some of the completed projects include:

- providing 14 isolation valves to over 90 miles of transmission pipeline for seismic mitigation
- implementing Mirabel site seismic improvements
- mitigating Santa Rosa Aqueduct seismic hazards over Rogers Creek Fault Crossing
- procuring large diameter flexible hose to deploy for emergency use
- procuring stockpile material for use in emergency
- developing a dedicated Emergency Operations Center
- installing additional UPS (uninterrupted power supply) units at each facility to prolong communications.

The total cost for the 32 projects was greater than 63.28 million dollars; additional projects are in progress at this time.

Hazard Risks and Water Shortage

Sonoma Water estimates that after a 7.0+ earthquake, potential damages to aqueducts and/or pumping stations would be restored within three days. Sonoma Water projects it has a day and a half of stored water available during the repair period. The contracting cities have similar water storage and well capacity to cover needs during repairs.

Three days is an optimistic estimate. Other factors and experience point to more extended water outages. Sonoma Water recently estimated that if emergency repairs to their River Diversion System (RDS) were needed, the restoration could take 2-3 weeks.

Water Sources:

On average, Sonoma Water supplies 90-95% of the water required by the nine contracting cities and local water agencies; the rest of the water, supplied from local wells, is not sufficient to sustain full flow needs.



According to FEMA,

“People have been encouraged to maintain an emergency supply of water. This has been widely interpreted as a recommendation to keep a three –day supply of water on hand. However, after a major earthquake that probably will not be enough. FEMA is recommending that you have enough water for each member of your family, to meet their needs for two weeks.”

Emergency relations officers within the county recommend that every household keep enough water for a week, and even that amount might not be enough. The East Bay MUD projects repair estimates of 1-2 weeks, and a significant period of water shortage. Estimates from the Los Angeles basin noted that it might take months to complete repairs to their three main aqueducts. They added that that shortfall could become a major issue for potable water, reduction of fire protection and sanitation operations with public health consequences. In 2015, Southern California’s Shakeout 2 Scenario, an earthquake practice drill, showed a “significant vulnerability in the conveyance system where pipes and other components cross or are located close to the San Andreas Fault. Major damage to the water system could leave the most affected areas without running water for up to 6 months.”

Sonoma Water’s optimistic estimate of three days is conditional on the availability of suitable repair parts, aqueduct pipe, joints, pumps and valves. The Grand Jury has surveyed the supply of repair parts around the aqueduct and found the inventory of emergency supplies is sparse and the inventory list is incomplete and out-of-date.

The 2018 California State Hazard Mitigation Plan noted that “based on the most recent earthquake forecast model for California, the USGS and other scientists estimate a 72% probability that at least one earthquake of magnitude 6.7 or greater, capable of causing widespread damage, will strike the San Francisco Bay Area before 2044.” While damage from an earthquake varies considerably from one scenario to another, people need to maintain personal emergency water supplies for substantially more than 3 days. “Despite the County efforts to reduce risks, no amount of planning or mitigation can prevent disasters from occurring or eliminate the risks of such events all together. The County’s actions may help to reduce the risks and impacts these hazards pose to life, property and the economy. While the Hazard Mitigation Plan seeks to identify opportunities for reasonable mitigation actions, each individual has a responsibility to be aware of the potential hazards where they live and to minimize their own household’s vulnerability.” (Sonoma County Hazard Mitigation Plan, October 2016)

Emergency Policies, Systems, and Program Weaknesses

In the event of an emergency, Sonoma Water activates an Emergency Operations Center (EOC) subordinate to the Sonoma County EOC. Sonoma Water serves the interests of citizens, drawing water from about 60 small, independent water systems scattered throughout the County. Sonoma Water EOC maintains contact with its operations through a Supervisory Control and Data Acquisition (SCADA), with the ability to dispatch corrective action if the water supply is disrupted. Procuring a mobile operations center with full SCADA capabilities is listed on the

2018 mitigation action sheet, but has not been implemented. Improvements in the SCADA system have been discussed but not implemented.

The ability of Sonoma Water and any utility to respond to failures depends on the rapid availability of qualified repair personnel, either on-staff or from mutual aid support. To be successful, advanced training and coordination is necessary.

For several years Sonoma Water has been working on their Emergency Plans, and completed the Continuity of Operations Plan (COOP) in June 2018. The COOP is a plan to continue essential governmental functions across a wide range of emergencies. The Emergency Response Plan has been replaced by the Sonoma Water Emergency Operations Plan, completed in 2017.

Water Agency Contractors' Emergency Actions

The Civil Grand Jury researched two cities to inform the public regarding the emergency response on the part of a sample of city water contractors, one with a large population and one with a smaller population.

City of Santa Rosa

The City has developed their own LHMP, Emergency Operations Plan Annex, and Urban Water Management Plan. Santa Rosa takes delivery from Sonoma Water at 60 psi (pounds per square inch). The water transmission system operates within zones and sectionalizing valves to permit failure isolation. If needed, a City well on Farmers Lane and Sonoma Avenue could provide water. The main water line down Sonoma Avenue was installed with flex couplings to allow for movement during earthquakes.

Restoration of water deliveries in Santa Rosa after an earthquake requires operating personnel to drive along the major pipelines, identify failures and fix them, or call a team for repairs. The Santa Rosa Water Department Operations Center (DOC), and The City of Santa Rosa Emergency Operations Center locate and acquire additional resources as necessary. Water emergencies might be addressed by third party contractors to import water or obtain bottled water, and then distribute the water through point of dispensing centers (PODs). Health and safety, as well as fire protection are prioritized.

Santa Rosa water workers (cross trained and certified in water and wastewater operations) are on mandated duty during emergencies. Most of the City workers live locally, with some living as far away as Ukiah. The standard work mode is for a two-person field crew team to follow water supply routes and report leaks to the DOC/EOC. At the DOC/EOC, the operations are logged on in conjunction with Geographic Information System (GIS) displays and hard copy map books.

The City of Santa Rosa Water and Wastewater group conducted earthquake drills from 1984 onward, believing earthquakes posed the most extreme risk. Those drills helped with the fires of October 2017, even though the drills were for an earthquake. In the past, none of the simulation drills were jointly done with Sonoma Water. The Santa Rosa Emergency Operations Plan lacks coordination with the other water contractors.

In Santa Rosa, if there were a sustained water shortage following an earthquake, people would be urged to shelter in place if possible, or relocate to one of the emergency centers such as Finley Park or a Place to Play, where tent camping might be an option. Back-up water delivery modes for Santa Rosa City include POD hose taps, milk trucks, bottled water, private wells, and additional wells for use during emergencies.

Santa Rosa Water has had no cross training with other organizations, although it does anticipate mutual aid through the California Master Mutual Aid Agreement. The City of Santa Rosa participates in Sonoma Water's Water Advisory Committee (WAC) and Technical Advisory Committee (TAC) meetings with other contractors to share information.

City of Sonoma

Water supplies in the City of Sonoma rely on Sonoma Water, supplemented by city wells especially during peak periods, drought, and emergencies. The City's water operations could get by for about two weeks if cut off entirely from Sonoma Water. They would rely on conservation, rationing, city well water, and whatever water remained in the city water tanks. This may require a work-around of any break in the line, using what is available, including hoses. Data from the City's water management plan suggests there is an expectation that consumers could get by on a 15-20% reduction of normal water flows for a limited time.

The City has backup materials on hand in their corporate yards for emergency repairs. The water supply line diameters are smaller than the Sonoma Water aqueduct. The smaller diameter pipes are more readily available. The water supply depends on electricity for pumping capacity, so the City of Sonoma has back-up emergency generators if needed.

The City of Sonoma has no LHMP but is considering other funding options. They have an updated EOP available on-line. The City is seeking a contract with a consulting engineering firm to conduct a risk assessment based on an emergency involving water. The City does outreach to their customers through their web site under Emergency Preparedness. The City of Sonoma participates in mutual aid contracts under the California Master Mutual Aid Agreement developed under the California Emergency Services Act. The City of Sonoma, along with the other eight contractors, participates with Sonoma Water's WAC and TAC advisory committees.

Sonoma Water System - Actions during an Emergency

Sonoma Water has a direct-to-consumer public information program aimed at water conservation, and is proud that their efforts have reduced average per-capita water consumption. In the absence of a similar campaign to bolster earthquake awareness and preparation, that responsibility is currently assumed unevenly by the retailing contractors/utilities.

Sonoma Water holds periodic coordination meetings with the nine water contractors, through the WAC and TAC committees. Sonoma Water does not conduct joint emergency training sessions with these contractors, but may contact them for help if needed. Sonoma Water has larger diameter transmission pipes than the water retailers, and skilled personnel versed in handling

them. Due to the larger diameter pipeline sizes, Sonoma Water staff would be the most available and best qualified to take care of most issues. Joint exercises would provide specialized training to the nine water contractors.

Emergency preparations include stockpiling spare pipe and valves at scattered corporate yards, including those at Wohler Bridge and Mirabel. Sonoma Water relies on good vendor relations to fill emergency needs if their inventory is not already on hand. Portable, flexible 12" hose line is available to bypass water outages. Problems with collector wells could create a special issue needing expert help from outside of Sonoma Water.

In addition to seismic events, the Local Hazard Mitigation Plan continues to address floods, droughts, wildfires, and sea-level changes - all exacerbated by climate change.

Throughout this investigation, the Civil Grand Jury has been impressed with the expertise, education and dedication of the staff at Sonoma Water and its contractors.

FINDINGS

F1. Sonoma County relies primarily on the Russian River for drinking water which may be disrupted in the event of a major earthquake.

F2. Sonoma County relies primarily on a single wholesale provider for its water. Sonoma Water, which delivers water under contract to cities and water districts in Sonoma County and northern Marin County, may be without sufficient resources to meet all emergency needs.

F3. In the event of a major earthquake, water supplies are likely to be significantly disrupted for extended periods of days or weeks, although reduced water supplies may be provided through alternative means. Full recovery of systems could take longer.

F4. Measures implemented by Sonoma Water to reduce the risk of critical water shortages following a major earthquake have relied heavily upon state and federal grant funds, but implementation has fallen behind the schedules proposed in the LHMP. A more rapid reduction of risks could be achieved through water rate adjustments.

F5. Consistent with FEMA recommendations, residents need to maintain their own emergency source of water to meet their personal needs for more than the three days frequently stated by officials.

F6. More public outreach is needed to educate water users to their risks and individual responsibility for earthquake preparedness.

F7. Coordination between Sonoma Water and its contractors needs to improve by increasing training exercises, mutual aid training, and systems information exchange.

F8. Because operating pressures must be maintained throughout the system, water contractors have limited ability to curtail non-essential water uses without compromising availability of water for critical applications such as fire suppression and hospital use.

F9. Sonoma Water's planning for earthquake response, supplies, repairs, and restoration of water depends significantly on institutional repair knowledge concentrated in a few long-term employees, but lacks adequate documentation such as manuals for standard operating procedures.

F10. Sonoma Water's estimate of three days to return to service following an earthquake is conditional on the availability of suitable repair parts, aqueduct pipe, joints, pumps and valves. The Grand Jury found the inventory of emergency supplies is sparse and the inventory list is incomplete and out-of-date.

F11. Sonoma Water and its water contractors maintain a well-designed system and have made significant progress in mitigating earthquake risks. Ongoing efforts are needed to reduce remaining risks.

RECOMMENDATIONS

The Sonoma County Civil Grand Jury recommends that:

R1 Sonoma Water review and establish viable options for accelerating how rapidly the highest-priority mitigation measures are being funded and implemented, by December 31, 2019. (F3, F4)

R2 Sonoma Water maintain inventory lists with current goals for items, quantities, locations, and sourcing; and improve stockpiling accordingly, by December 31, 2019. (F10)

R3 Sonoma Water and water contractors derive and publicize more realistic outage periods and provide updated information to the public, by December 31, 2019. (F5, F6)

R4 Sonoma Water improve coordination with water contractors, including field exercises, by December 31, 2019. (F7)

R5 Water contractors study options for making local systems more adaptable under emergency conditions - such as dedicated supply loops, digitally monitored metering, or automatic shut-down valves, by December 31, 2019. (F8)

R6. Sonoma Water prepare and maintain one or more SOPs (Standard Operating Procedures) for the restoration of water deliveries specifically for an earthquake; SOPs should be updated annually or whenever there are changes to procedures, by December 31, 2019. (F9)

REQUIRED RESPONSES

Pursuant to Penal Code sections 933 and 933.05, the Grand Jury requires responses as follows:

R1, R2, R3, R4, R6 Sonoma Water

R5 Water Contractors: Santa Rosa, Rohnert Park, Cotati, Petaluma, Sonoma, Windsor, Valley of the Moon Water District, Marin Municipal Water District, and North Marin Water District

GLOSSARY

ABAG – Association of Bay Area Governments
CAL-OES – California Office of Emergency Services
DOC – Department Operations Center
EOC – Emergency Operations Center,
EOP- Emergency Operations Plan
FEMA – Federal Emergency Management Agency
LHMP – Local Hazard Mitigation Plan
PG&E – Pacific Gas and Electric
POD – Point of Dispensing site, for water
SCWA – Sonoma County Water Agency/ Sonoma Water/SW
SCADA – Supervisory Control and Data Acquisition
SOP- Standard Operating Procedure
TAC – Sonoma Water’s Technical Advisory Board
USGS – United States Geological Survey
WAC – Sonoma Water’s Water Advisory Board

BIBLIOGRAPHY

Water and Earthquake

“Best Management Practices Framework in California.” California Department Water Resources. 10/2016.

“Biological Opinion.” Environmental Species Act. September 2008.

“Federal Grant for Water System Disaster Preparedness.” Awarded to Sonoma Water. Sonoma County Gazette. 12/17/18.

FEMA emergency water recommendations: web site -<https://www.fema.gov/txt/library/f&web.tx>

“Final Memorandum of Understanding Regarding Water Transmission System Capacity Allocation during a Temporary Impairment.” SCWA and Distributors. 10/16/06.

“Global Risks 2018: Fractures, Fears and Failures.” The Global Risks Report. 2018

“New Map of Rodgers Creek Fault in Sonoma County, California.” USGS. 7/2018.

“Practical Lessons from Loma Prieta Earthquake – 1994.” National Academies Press. 10766

“Proposal for Emergency Water Supply Memo.” GHD report. 11/5/18. Number 11177640.

“Reassessing the Effectiveness of All-Hazards Planning.” Inquiries. 2015.

“Restructured Agreement for Water Supply.” SCWA and Distributors. 6/23/06.

“Rodgers Creek and Hayward Faults are revealed to be one Fault, capable of a Magnitude – 7.4 earthquake.” Science Advances. Temblor. 1/6/2017.

“Scientists Discover Sonoma County Earthquake Fault connected to Hayward Fault.” Press Democrat. Nett. 2/21/2018.

“Sonoma County Hazard Mitigation Plan.” SCHMP. Chapter 1. 2016.

“Sonoma County Hazard Mitigation Plan.” SCHMP. Seismic Hazards. 2017. “Sonoma County Operational Area – Emergency Operations Plan.” Threat Summary and Assessments. October 2014.

“Southern California Water Supplies Vulnerable to big Earthquake.” UC Regents. Chakrabarty. 2016.

State of California Multi-Hazard Mitigation Plan 2018. CA Governor’s Office of Emergency Services. 4/2018.

Sonoma County Water District

SCWA – Current Budget, FY 2018-2019, SCWA – Emergency Operations Plan, Earthquake plan. Doc.159969. Wyatt. 2017.

SCWA – Emergency Operations Plan, Earthquake Plan. Doc 159969. Wyatt. 2017

SCWA- Frequently Asked Questions, sonomawater.org

SCWA – Local Hazard Mitigation Plan. 2018

SCWA – Russian River System, July 2001

SCWA – 10 year Summary of Planned Water Supply and Reliability Projects, 2012-2013.

SCWA – Urban Water Management Plan 2015. 2016.

SCWA – Water Billing History, 1995-2019

City of Santa Rosa and City of Sonoma

“Capital Improvement Projects List.” City of Santa Rosa.

“City of Santa Rosa 2017 Local Hazard Mitigation Plan”

“Emergency Operations Plan.” City of Sonoma. November 2015

“Emergency Operations Plan.” Part II: Hazard Annexes Earthquake. City of Santa Rosa. 6/2017

“2015 Urban Water Management Plan.” City of Santa Rosa. 2015