BAY AREA WATER SUPPLY AND CONSERVATION AGENCY
BOARD OF DIRECTORS MEETING

July 10, 2020

Correspondence and media coverage of interest between June 22, 2020 and July 6, 2020

Correspondence

From: Nicole Sandkulla, CEO/General Manager, BAWSCA
Date: June 22, 2020
Subject: Projected Wholesale Customer Water Purchases from the San Francisco Regional Water System

From: San Francisco Public Utilities Commission
To: Nicole Sandkulla, BAWSCA CEO/General Manager
Date: June 26, 2020
Press Release: Construction Work Begins on New Alameda Creek Watershed Center in Sunol

Media Coverage

COVID-19:

Date: July 6, 2020
Source: Pacific Institute
Article: How the Coronavirus Pandemic is Affecting Water Demand

Date: June 30, 2020
Source: American Water Works Association
Article: Workplace social distancing, declining revenue among water sector concerns during pandemic

Water Management:

Date: July 3, 2020
Source: California Department of Water Resources
Article: DWR Announces $83.9 Million in Grants for Local and Regional Water Resilience Projects

Date; June 23, 2020
Source: California Department of Water Resources
Article: How DWR Research is Improving Forecasting for California's Variable Climate

Date: June 23, 2020
Source: Public Policy Institute of California
Article: California's 21st Century Megadrought

Date: June 2020
Source: American Society of Civil Engineers
Article: Risk, Resilience, Response

Water Infrastructure:

Date: June 26, 2020
Source: San Francisco Chronicle
Article: SF commission breaks ground on nature center near Sunol to spotlight its water

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BAWSCA
Bay Area Water Supply & Conservation Agency

June 22, 2020

The Hon. Ann Moller Caen, President
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102

SUBJECT: Projected Wholesale Customer Water Purchases from the San Francisco Regional Water System in Compliance with Section 4.05 of the 2018 Amended and Restated Water Supply Agreement between San Francisco and its Wholesale Customers

Dear President Caen,

Section 4.05 of the 2018 Amended and Restated Water Supply Agreement between the City and County of San Francisco and its Wholesale Customers (Agreement) requires the San Francisco Public Utilities Commission (SFPUC) to annually prepare a Water Supply Development Report (Report) for consideration by the Commission each December. The need to report is in effect through December 31, 2028.

The Agreement provides that the Bay Area Water Supply and Conservation Agency (BAWSCA) will provide the SFPUC with water purchase projections for the Wholesale Customers to be utilized in the Report. These projections are to be submitted by BAWSCA to the Commission by June 30 each year beginning 2010.

Based on information provided to BAWSCA by its member agencies, the aggregate Wholesale Customer Water Purchases in FY 2027-2028 are currently projected to be 166 MGD.

The enclosed Table 1 summarizes the projected purchases from San Francisco for each Wholesale Customer in FY 2027-28. This table was prepared using data documented in the *BAWSCA FY 2018-19 Annual Survey*.

BAWSCA looks forward to working with your staff as the Report is prepared for the Commission's consideration this coming December. If you have any questions, please contact Tom Francis, BAWSCA Water Resources Manager, at 650-349-3000.

Sincerely,

Nicole M. Sandkulla
Chief Executive Officer/General Manager

Enclosure:

- Table 1: Projected SFPUC Purchases by the BAWSCA Member Agencies in FY 2027-28

cc: Harlan Kelly, SFPUC General Manager
BAWSCA Board of Directors
BAWSCA Member Agency Representatives
Allison Schutte, Hanson Bridgett

Table 1
Projected SFPUC Purchases by the BAWSCA Member Agencies in FY 2027-28

BAWSCA Member Agency	Individual Supply Guarantee (mgd)	Projected SFPUC Purchases in FY 2027 - 28 (a) (mgd)
Alameda County WD	13.76	8.49
Brisbane/GVMID	0.98	0.97
Burlingame	5.23	4.96
Coastside County WD	2.18	2.19
CWS - Bear Gulch, Mid-Peninsula, and SSF Districts	35.68	32.89
Daly City	4.29	4.29
East Palo Alto **(c) (d)**	3.46	2.98
Estero Municipal ID	5.90	4.17
Hayward	--(b)	23.11
Hillsborough	4.09	3.04
Menlo Park	4.46	4.47
Mid-Peninsula WD	3.89	3.11
Millbrae	3.15	2.70
Milpitas	9.23	6.50
Mountain View **(c)**	12.46	8.76
North Coast County WD	3.84	3.20
Palo Alto **(d)**	16.58	10.09
Purissima Hills WD	1.63	2.17
Redwood City	10.93	10.29
San Bruno	3.25	2.83
San Jose	0 (b)	6.57
Santa Clara	0 (b)	4.50
Stanford University	3.03	1.68
Sunnyvale	12.58	10.95
Westborough WD	1.32	0.81
Member Agency Total (e):	**--**	**166**
Total Supply Assurance:	**184**	**--**

Notes:

(a) Source: BAWSCA FY 2018-19 Annual Survey, Table 3E-1 (Demand Projects by Source). Projections derived by straighlining the projected purchases in FY 2025-26 and in FY 2030-31.

(b) Hayward does not have a fixed ISG. San Jose and Santa Clara are temporary and interruptible customers of the SFPUC and do not have an ISG.

(c) Individual Supply Guarantees for East Palo Alto and Mountain View were adjusted to address a 1 MGD transfer that took place in FY 2016-17.

(d) Individual Supply Guarantees for East Palo Alto and Palo Alto were adjusted to address a 0.5 MGD transfer that took place in FY 2017-18.

(e) BAWSCA is preparing a demand study update. That update will be completed by June 30, 2020 and could influence future purchase projections.

Abbreviations:

CWS = California Water Service
GVMID = Guadalupe Valley Municipal Improvement District
ID = Improvement District
ISG = Individual Supply Guarantee
mgd = million gallons per day
WD = Water District

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NEWS RELEASE

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FOR IMMEDIATE RELEASE

June 26, 2020

Construction Work Begins on New Alameda Creek Watershed Center in Sunol

The Center will raise awareness of the natural and cultural history of the Alameda Creek Watershed and the Hetch Hetchy Regional Water System

San Francisco, CA—Construction work has begun on the San Francisco Public Utilities Commission's (SFPUC) Alameda Creek Watershed Center in Sunol, which will raise awareness of the natural and cultural history of the Alameda Creek Watershed and the Hetch Hetchy Regional Water System.

Located next to the Sunol Water Temple in the East Bay at the historic confluence of two creeks, the Alameda Creek Watershed Center will explore the interaction of people and nature and the significance of water in sustaining both. The location of the center is the ancestral home of the Muwekma Ohlone Tribe.

"This center will offer opportunities to learn about the past, present and future of the Alameda Watershed while also educating visitors about our water system," said SFPUC General Manager Harlan L. Kelly, Jr. "We understand why this land is important to so many people, and we are excited to celebrate that rich history here at the center. From the art to the amenities to the resources available—this will truly be a community center for everyone."

The SFPUC and the Muwekma Ohlone Tribe began a multi-year partnership on the pre-excavation, study, and careful preservation of archaeological finds from the Watershed Center area. The lessons of what has been discovered there, and replicas of some of the more than 13,000 artifacts that have been found will be reflected in the Watershed Center exhibits and education programs.

"The proposal for the construction of the SFPUC educational Watershed facility, located adjacent to the Sunol Water Temple commenced with discussions and the establishment of a partnership of mutual respect, understanding and common goals between the SFPUC and the Muwekma Ohlone Tribal leadership back in 2014," said Muwekma Ohlone Tribal Vice Chairwoman Monica V. Arellano, who has worked closely with the SFPUC staff in all phases of work. "It is in this spirit of mutual cooperation and respect that the Muwekma Ohlone Tribe looks forward to the completion of this significant educational endeavor at our ancestral heritage site that the Tribal leadership has named *Síi Túupentak* meaning Place of the Water Round House Site. Aho!"

The center will have indoor and outdoor features, including an exhibit hall with an 8,000-gallon stream profile aquarium, a watershed discovery lab to host school programs, a community room, a watershed discovery trail that mimics the flora of the Alameda Creek Watershed, semi-immersive history alcoves,

and the restoration of the picnic area nestled under sycamores along the creek. It will also include an outdoor art installation designed by Walter Kitundu, a nationally-celebrated artist and MacArthur Fellowship recipient. Kitundu's proposed design, titled *Ruupaywa*, pays tribute to the Alameda Creek Watershed and the historical and contemporary Muwekma Ohlone people. The eagle is a significant figure in the creation story of the Muwekma Ohlone people, and the Alameda Creek Watershed is one of the nation's top nesting sites for Golden Eagles.

Pre-construction activities began in March 2020, but were temporarily put on hold due to public health orders related to the coronavirus pandemic. Construction activities re-started on May 11th after Bay Area Health officers loosened restrictions on construction activities. Crews on site follow strict safety measures to protect the health of our workers and the public. Construction of the center is scheduled for completion in March 2022.

The SFPUC owns approximately 38,000 acres of the Alameda Creek Watershed, which includes lands in both Alameda and Santa Clara Counties. These lands contain two drinking water reservoirs -- San Antonio Reservoir to the north and Calaveras Reservoir to the south. Calaveras Reservoir is the largest of the SFPUC's five Bay Area reservoirs, which, when combined with groundwater, collectively account for 15 percent of the agency's total supply. Hetch Hetchy Reservoir in the Sierra Nevada provides roughly 85 percent of the SFPUC's water supply.

The SFPUC is committed to being a good neighbor and environmental steward in the communities we serve. Along with the Southeast Community Center, the SFPUC manages community and education-focused sites on property that it owns such as the College Hill Learning Garden, the Sunol AgPark and Hummingbird Farm.

The SFPUC has been working with community partners on these efforts for decades, which were formalized in our Community Benefits and Water Enterprise Environmental Stewardship policies. These initiatives shape how the SFPUC provides water, power and sewer services while ensuring the work positively impacts the communities it serves.

"The Watershed Center will take Sunol into the future," said Connie De Grange, a local resident and chair of the Sunol Citizen Advisory Council. "The opening of the Watershed Center, the Water Temple and the picnic area will bring renewed life to our little town. The purpose of the new Center aligns with the values of Sunol: protecting the watershed, preserving the environment, and celebrating our history."

In March the SFPUC began work on its new Southeast Community Center in San Francisco's Bayview neighborhood. Owned and operated by the SFPUC, the center will provide community meeting rooms, two acres of green space, and a wide range of social services including low cost child care and youth programs.

About the San Francisco Public Utilities Commission

The San Francisco Public Utilities Commission (SFPUC) is a department of the City and County of San Francisco. It delivers drinking water to 2.7 million people in the San Francisco Bay Area, collects and treats wastewater for the City and County of San Francisco, and generates clean power for municipal buildings, residents, and businesses. Our mission is to provide our customers with high quality, efficient and reliable water, power, and sewer services in a manner that values environmental and community interests and sustains the resources entrusted to our care. Learn more at www.sfwater.org.

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How the Coronavirus Pandemic is Affecting Water Demand
Pacific Institute | July 6, 2020 | Heather Cooley

Changes in Water Demand

The COVID-19 pandemic has imposed massive health and economic burdens on communities around the world, and no sector of society is going untouched, including the vitally important water sector. The full extent of impacts of the coronavirus pandemic on the water sector are still emerging, but one area that has come to the fore is the effect on municipal water demand. Available data indicate that residential water demand has increased while non-residential demand has decreased. In Portsmouth, England, for example, residential demand increased by 15 percent during the lockdown, while non-residential demand declined by 17 percent. Likewise, in San Francisco, California, residential demand increased by 10 percent, while non-residential demand declined by 32 percent.

“Available data indicate that residential water demand has increased while non-residential demand has decreased.”

These changes are, in part, due to the simple fact that people are doing more at home during the coronavirus pandemic – like cooking, washing dishes, flushing toilets, and showering – and less in the office, at restaurants, and at the gym. Moreover, while business is up for a handful of sectors – like hospitals and some food production – other important water-using sectors of the economy have slowed or shut down entirely.

The net effect of the COVID-19 pandemic on total water demand varies from community to community, depending on the relative proportion of residential and non-residential water uses and the makeup of the non-residential sectors. Most communities – including larger metropolitan systems in Boston (Massachusetts) and Austin (Texas) – have experienced a reduction in total water demand. More residential communities have experienced either modest increases or the smallest decreases.

A Ripple of Effects

Sudden changes in the levels and patterns of water demand from stay-at-home orders and business shutdowns can have knock-on effects, affecting building water quality, customer water bills, utility revenue, and water and wastewater operational conditions:

Building Water Quality: Under normal conditions, the regular flow of disinfected tap water keeps water and plumbing free of corrosion, leached minerals, and bacteria. But when water systems are shut down or inactive for weeks or months, residual disinfectants in water, such as chlorine, can dissipate. Several potential hazards must be considered before reopening buildings or water systems, including the risk of mold, Legionella (the cause of Legionnaires’ disease), leaching of lead and other metals, and the presence of disinfection by-products. Many building owners are unaware of the risks and the actions they should take, and there are no official national or industry regulations for safely reopening buildings after extended shutdowns.

Customer Water Bills: Changes in water use will lead to changes in customer bills. Because water bills typically include a fixed fee that would remain unchanged, the change in the bill is typically considerably less than the change in water usage, i.e., the additional cost of a 10 percent increase in water usage would be much less than 10 percent. But for those already struggling to pay bills or newly unemployed, even a modest increase in household bills can be problematic. Businesses are likely to see costs go down temporarily, but these savings are moderated by fixed fees and could still be problematic for those that are shutdown.

“For those already struggling to pay bills or newly unemployed, even a modest increase in household bills can be problematic.”

Utility Revenue: Utilities where total water use has declined during the coronavirus pandemic will see a drop in revenue. Revenue losses are compounded by higher costs and likely increases in non-payment, putting further pressures on water utilities. For example, a survey of U.S. water utilities during the pandemic indicated that some are offering hazard pay and overtime to essential workers, expanding training, and spending more on certain supplies. Moreover, many states have placed a temporary moratorium on customer disconnections, further affecting revenue. Impacts are likely to be more severe for small utilities, as they have a smaller customer base to absorb revenue losses.

Water and Wastewater System Operations: Even with a small change in total water demand, changes within a water system may be more dramatic. For North Carolina’s Cape Fear Public Utility Authority, water demand across its service area was down only three percent, but demand in two subsystems serving largely residential areas increased by 25 percent and 36 percent. Moreover, as businesses reopen and implement hygiene and disinfection practices and as temperatures rise, water use may rise dramatically. Such rapid and dramatic changes in water use can exacerbate existing — and reveal new — system weaknesses. Managing these weaknesses may be more difficult as operators adjust to reduced staffing, working remotely, and other changes related to the COVID-19 pandemic. Here, too, small water systems are more vulnerable because they have fewer operators.

Some of these impacts will be short-lived, generally limited to the period when stay-at-home orders are in place and businesses closed. However, there could be longer-term impacts if, for example, the pandemic remains out of control, unemployment remains high, people continue to work from home, or there are deeper changes to the economy.

“There could be longer-term impacts if the pandemic remains out of control, unemployment remains high, people continue to work from home, or there are deeper changes to the economy.”

There is still much we don’t know. For example, we don’t know the extent or duration of the pandemic, or the range of impacts on different water systems, or the effectiveness of efforts to mitigate these impacts. But we do know that we are facing a more variable and uncertain future

– from social disruptions like the COVID-19 pandemic to more extreme droughts and floods due to climate change. Immediate action is needed to ensure the safety of water during building reopening, and sustained effort is needed improve the financial and operational resilience of water utilities to ensure that they can continue to provide critical water and wastewater services.

Ensuring Water Safety During Building Reopening

- Building operators and managers should take immediate proactive steps to protect public health by addressing building water quality prior to reopening, and actions taken should be shared with building occupants.
- Water utilities should proactively reach out to commercial and industrial customers with information about safe reopening procedures. In North America, the American Water Works Association (AWWA), Canadian Water and Wastewater Association, CDC, U.S. EPA, and other groups offer recommendations for both specific actions and community outreach.
- Facilities with their own water systems must consider protective actions. Groups that maintain their own water supply, including some schools, restaurants, churches, and recreational facilities, should contact their primacy agencies with specific questions.
- Local, state, and federal agencies should make special efforts to reach out to groups with limited access to technical expertise and financial resources. This includes small rural water systems, disadvantaged communities, Native American communities, and other groups with special water supply and quality challenges.

Enhancing Water Utility Resilience

- Water utilities should expand their efforts to develop more robust and sophisticated “resilience” plans. Such plans can help water utilities prepare for and mitigate a wider range of risks than traditional planning approaches have addressed, including extreme climatic conditions, health threats like the COVID-19 pandemic, and the failure of key infrastructure.
- Water utilities and municipalities should accelerate the pace and scale of digital monitoring and operational technologies. Such technologies can provide advance notice of developing problem and allow the continued safe operation of critical systems even with reduced staffing and shelter-in-place orders.
- Water utilities should proactively update their pricing and financial policies. While it may not be feasible to change pricing policies in response to the immediate impacts of the pandemic, changes may be needed to address the longer-term economic impacts and build resilience to future crises. Some strategies that should be evaluated include budget-based or inclining block rates, drought surcharges, and cash reserves.
- Water utilities should consider purchasing commercial insurance products that provide coverage for business interruptions. While commercial products may not specifically address all the challenges posed by the pandemic, more general policy terms can be negotiated in case of future disruptions.
- National governments and international aid agencies should increase financial assistance and accelerate the disbursement of this assistance. Financial assistance can

help ensure much-needed utility infrastructure investments are maintained and stimulate economic recovery. Such funding should be prioritized for small systems and for projects that (1) enhance sustainability and resilience outcomes and (2) serve disadvantaged communities that lack comprehensive access to safe water and sanitation.

Learn more in the Pacific Institute Issue Brief Water and the COVID-19 Pandemic: Impacts on Municipal Water Demand.

# # #

Workplace social distancing, declining revenue among water sector concerns during pandemic

American Water Works Association | June 30, 2020

Most water utilities are returning to normal operations as they reopen their offices and relax some of the measures they put in place during the first months of the COVID-19 pandemic, according to a recent survey conducted by the American Water Works Association (AWWA).

Conducted June 8-15, this is the fourth in a series of surveys about how AWWA member organizations are adapting to impacts of the COVID-19 pandemic. The survey closed shortly before many communities reported rising cases of COVID-19.

Utilities surveyed also reported the most common challenges were social distancing at the workplace, supply chain disruptions for personal protective equipment (PPE) and declining revenue generation. More than a third (36 percent) of utilities surveyed reported PPE supply chain disruptions and more than one quarter (28 percent) are out N95 masks. This represents a drop from AWWA's last survey (April 17-22, 2020) when 56 percent of surveyed utilities reported disruptions in PPE supply chain.

The number of utilities that temporarily implemented policies to mitigate COVID-19 risks – shift changes, travel restrictions, remote work where possible -- dropped by about 30 percent between AWWA surveys in late April and June. There was also an 11 percent drop in utilities reporting that they suspended water shut-offs between surveys, but still a large majority of utilities have this policy in place (96 percent in April, 85 percent in June).

Seventy-five percent of surveyed utilities say their offices are open (including 21 percent that didn't close their office at all during the pandemic). These utilities are taking actions to prevent the spread of COVID-19 in the workplace, including implementing enhanced sanitizing procedures (91 percent), reducing size of in-person meetings (76 percent), and requiring face coverings (67 percent).

While PPE supply issues appear to be easing somewhat, the portion of utilities reporting declining revenue generation increased from 23 percent in late April to 32 percent in June. Additionally, 24 percent said they are expecting to see revenue issues in the next month. As a result, 46 percent of utilities have already implemented spending adjustments and another 24 percent said they are considering it.

For the service providers who support the water sector, 46 percent of those surveyed said they are experiencing revenue generation issues and about two-thirds indicate they have implemented spending adjustments. Like utilities, most will have re-opened their offices by the end of June (70 percent); however, service providers are more likely than utilities to maintain policies like work from home and travel restrictions. Service providers have also established policies to help protect their employees from COVID-19, with almost all surveyed reporting enhanced disinfection and sanitizing procedures (94 percent) and about 75 percent implementing flexible work from home policies.

The fourth survey of AWWA member organizations generated 464 responses, including from 421 different utilities and 39 non-utilities (consultants, manufacturers, service providers and others). The responses provide a real-time assessment of how water sector organizations are currently managing impacts of the COVID-19 pandemic.

AWWA offers resources to assist utilities with dealing with the challenges that arise during the pandemic at awwa.org/coronavirus.

# # #

DWR Announces $83.9 Million in Grants for Local and Regional Water Resilience Projects

California Department of Water Resources | July 3, 2020

The Yuba River a tributary of the Feather River flows east to west from the Sierra Nevada Mountains into the Sacramento Valley in Northern California. Some of today's grant awards will fund projects to sustain fisheries and improve water quality in the Yuba River watershed.

SACRAMENTO, Calif. – To continue California's progress toward establishing a more climate resilient future, today the Department of Water Resources (DWR) awarded $83.9 million in grants to communities in the Sacramento, San Joaquin, San Diego, Sierra and Central Coast regions.

Funded by voter-approved Proposition 1 and provided through DWR's Integrated Regional Water Management (IRWM) Program, these funds will support projects that address aging infrastructure, flood control, depleted groundwater levels and other critical needs in communities throughout the state. Approximately $31.4 million of the funding announced today will go toward projects that also provide direct benefits to disadvantaged and underrepresented communities, including Tribes. This is the third set of funding awards that have been released under this program since April 2020.

"Water is such a vital resource, that it is critical we continue to take action to ensure communities have access to clean water supplies, reliable flood protection and healthy ecosystems" said DWR Director Karla Nemeth. "These grants will support agencies and projects to continue local momentum in creating a more diverse water supply portfolio, strengthening partnerships and addressing climate change."

Among the awarded projects is an effort by the Sewage Commission-Oroville Region in Northern California that received $3.8 million in grant funding to replace and improve infrastructure for collecting, treating and reusing wastewater. These upgrades will improve water quality in the Feather River – a critical water supply source for the region and the state. Additionally, this project will enhance riparian and fish habitat, improve fish passage and protect the endangered spring-run Chinook salmon and other fisheries of the Feather River.

A multi-benefit project in the Lower Cosumnes River watershed that addresses weather extremes brought on by climate change was awarded $1 million. Water will be diverted from a nearby water supply canal during heavy storm periods and spread on 129 acres of agricultural land, allowing recharge of the groundwater basin for later use during dry periods. The land also provides habitat for the endangered Swainson's hawk. The project demonstrates an innovative technique referred to as Flood Managed Aquifer Recharge, as well as strong collaboration between local public agencies and non-governmental stakeholders to develop innovative solutions on a broad, regional scale.

A $1.32 million grant was awarded to the Merced Irrigation District to reduce flood risk and provide more reliable drinking water supplies for the disadvantaged communities of Le Grand and other surrounding areas. The project will redirect and control flood flows by constructing a set of gates in the Le Grand Canal, a critical water supply and flood control facility operated by the district. This project will also create groundwater recharge opportunities to increase water reliability and security for the local communities.

National City located in San Diego County was awarded $3.7 million in funding for a multi-benefit community enhancement project in Paradise Valley Creek. The project will divert stormwater runoff to a biofiltration basin where pollutants will be removed and replace old concrete lining in the creek with more fish-friendly natural streambank reinforcement. The project will reduce flood hazards to 16 homes located along the creek.

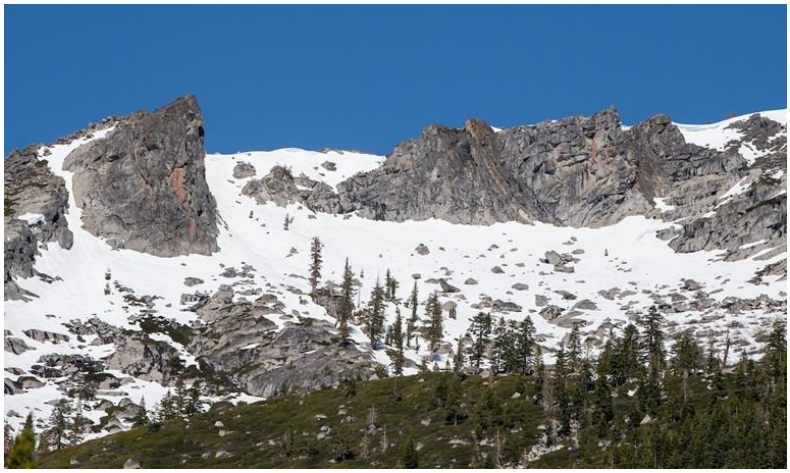
A grant of more than $1 million was awarded to the Central Coast Wetlands Group and City of Salinas. The entities are partnering to make critical improvements to existing stormwater and wastewater infrastructure, enhancing the ability of these systems to capture, store and convey water for various beneficial uses and reduce downstream flooding. These efforts will also help in protecting regional groundwater supplies currently used for drinking water and agricultural irrigation and establish a water supply reserve that can be used during dry conditions.

The Mariposa County Resource Conservation District was awarded approximately $700,000 for the Bootjack Fire Station Water Storage Project, which will increase the amount of water locally available to fight the increasing number of wildfires in the watershed.

With today's announcement, nearly $175.1 million has been awarded to date, and the remaining award of about $37 million for the Los Angeles/Ventura funding area will be announced in the near future.

# # #

How DWR Research is Improving Forecasting for California's Variable Climate
California Department of Water Resources | June 23, 2020



Mountainside still holds on to snow near Phillips Station in the Sierra Nevada Mountains, the site of the DWR final snow survey of the 2020 season. Photo taken April 30, 2020. DWR/2020

California has the most variable weather conditions in the United States, often varying between extremes such as drought and flood. Our ability to forecast variable weather conditions well in advance is a driving factor in how water managers maximize the benefits and minimize the hazards of each storm.

California's climate, and how it is changing

Precipitation variability in California is due to our Mediterranean climate, characterized by long, dry summers and mild, rainy winters. Typically, we rely on five to seven significant storms for the bulk of our annual precipitation.

On average, California receives about 200 million acre-feet of water per year in the form of rain and snow. However, we rarely experience an average year. Instead, California's snowpack has been alternating between extreme wet and dry years. Over the last decade we've seen three of our smallest snowpacks on record --and three of our largest snowpacks.

Increased temperatures lead to precipitation that falls as rain instead of snow, which increases the frequency of winter floods. Additionally, rain results in immediate runoff into reservoirs, requiring reservoir operators to increase releases to maintain flood control space. In cold years, precipitation is stored in solid form as snow, which slowly melts in the spring and summer months for water supply, agriculture, recreation, power generation, and more.

"The narrative around climate change describes warming temperatures leading to increasing variability and extremes in precipitation, and a transition toward more rain and less snow," said DWR's State Climatologist Dr. Michael Anderson. "The past decade is an indication of how this expectation is now becoming a reality."

Atmospheric rivers account for 40 to 60 percent of California's annual precipitation. As climate change continues to warm the atmosphere, the variability in number, strength, and duration of these storms is expected to increase. This means that it might be possible to have fewer atmospheric rivers, indicative of a dry year outcome, but have one of these storms be large enough to cause flooding.

The long-term sustainability and reliability of water in California requires that we all work together to find solutions, using the best science and technology available in forecasting.

Research into Forecasting

As variable climate conditions increase in frequency, DWR is working with state, federal, and academic research partners to improve our capabilities to monitor, forecast, and respond to impacts from climate change.

DWR started investing in improving our abilities to monitor and forecast the impacts of climate change in 2007. These investments included tools that make use of our growing knowledge of atmospheric rivers and their impact on California's water resources.

Adding to existing federal funding in these areas, DWR has invested approximately $40 million in the past 13 years, enabling greater outcomes through collaboration.

One example of DWR's investment into emerging technologies is using Light Detection and Ranging (LIDAR) – a detection system using light from a laser – to provide detailed spatial information about the ground surface and vegetation. This technology is used in remote areas normally inaccessible to manual snow surveys; having access to this data improves our snow melt and water supply forecasting abilities.

In partnership with DWR, researchers from the Desert Research Institute (DRI) developed new technology to interpret data collected from the ground, unmanned and human-piloted aircraft, and satellites about our atmosphere, rainfall, snowpack, rivers, and vegetation.

"Both satellites and aircraft provide information about atmospheric conditions that we would otherwise be unable to observe," said Dr. Benjamin Hatchett with DRI. "Satellites give us a global perspective and local picture that is important for understanding how the landscape will respond to a storm event or how it has been responding to past conditions. This information is also extremely important for weather forecast models to ensure high quality forecasts are produced by using the most up-to-date conditions of the Earth system."

DWR utilizes technologies developed by DRI and other partners to improve forecasting and better understand climate change and variability.

The Department's Forecast-Informed Reservoir Operations (FIRO) program is one example of how these emerging technologies are used to improve the forecasting of runoff into reservoirs and to better coordinate flood releases made from those reservoirs. These technologies give reservoir operators advance insight into the size and strength of incoming weather systems, and through FIRO, the ability to release water days before a storm impacts a region. This creates needed space in the reservoir to accommodate the runoff from an incoming storm, therefore limiting potential impacts to downstream communities.

Adapting to a changing climate for water management and emergency response will require improvements in our understanding of extreme and variable conditions. DWR's investments the past 10 years are just the start of enabling our staff to be more effective in responding to our changing climate. But continued investment is needed to transition from pilot efforts to full deployment to prepare California for what comes next.

# # #

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California's 21st Century Megadrought
Public Policy Institute of California | June 23, 2020 | Jeffrey Mount, Michael Dettinger

Low Water Drought Conditions at Folsom Lake, California

NEVER MISS AN UPDATE!

A recent paper on climate change in California and the West has been in the news and raising concerns. Based on extensive analysis of tree ring data—a good measure of summer soil moisture—the authors postulate that most of the region is in an unfolding "megadrought" that began in 2000 and is the second worst in the past 1,200 years.

What does this mean for California water management? If the state is in a megadrought, it means a great deal. We should plan accordingly.

Megadrought is a term of art, but essentially it refers to decades-long periods of low precipitation and soil moisture, often associated with reduced mountain snowpack. These periods are chronically dry, with less frequent wet years and drier dry years.

California's climate signals suggest that the state is experiencing a megadrought along with much of the West, as evidenced by precipitation and, perhaps most important, temperature anomalies.

In the figure below we plot the departure from average statewide precipitation over the past 70 years (since our modern water supply system was put in place and high-resolution climate data was collected). Starting in 1999 the state entered a 22-year period (including this year) where dry years occurred three times more often than wet years. This is roughly double the frequency of dry years compared to records going back to the late 1800s.

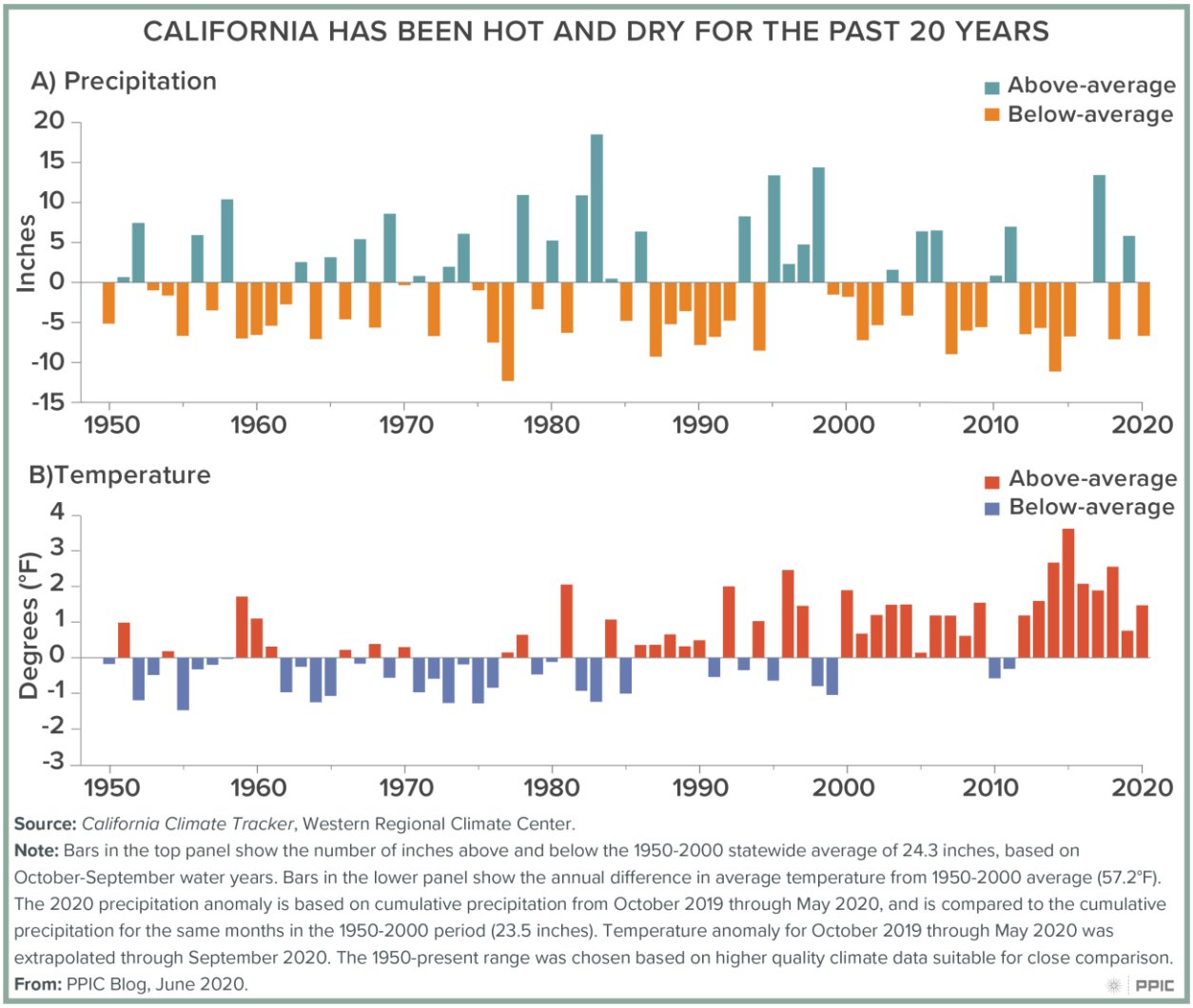
The occurrence of significantly more dry years than wet years over the past two decades has created a cumulative precipitation "deficit" that is quite large—bigger than any 20-year period in the past 70 years (and comparable to the extended dry period that included the Dust Bowl).

But this alone does not make for a megadrought. The other key factor is temperature.

Warm years diminish snowpack, reducing an important source of spring runoff into reservoirs. Extended warm and dry periods lead to snow droughts. However, the big effect of warming may be on evaporative demand. Think of it as the “thirst of the atmosphere.”

California’s relatively dry atmosphere has a high evaporative demand year-round. On average, roughly two-thirds of precipitation that falls on the state is returned to the atmosphere through evaporation and transpiration by plants. During warm periods evaporative demand increases, reducing the proportion of precipitation that remains as soil moisture or becomes runoff.

As the figure shows, the 21st century has been exceptionally warm—the warmest period since comprehensive record keeping began. This has amplified the impacts of precipitation deficits and gives reason to believe California is in an unfolding megadrought.



Source: *California Climate Tracker*, Western Regional Climate Center.

Note: Bars in the top panel show the number of inches above and below the 1950-2000 statewide average of 24.3 inches, based on October-September water years. Bars in the lower panel show the annual difference in average temperature from 1950-2000 average (57.2°F). The 2020 precipitation anomaly is based on cumulative precipitation from October 2019 through May 2020, and is compared to the cumulative precipitation for the same months in the 1950-2000 period (23.5 inches). Temperature anomaly for October 2019 through May 2020 was extrapolated through September 2020. The 1950-present range was chosen based on higher quality climate data suitable for close comparison.

From: PPIC Blog, June 2020.

PPIC

Implications for water management

During dry periods, reservoirs are drawn down until they can no longer supply more water than nature provides in a given year. Groundwater pumping increases to make up the difference. When a drought is “broken” by a wet year, California’s reservoirs fill quickly because their storage volume is small relative to runoff. But aquifers, which rely on the slow percolation of water through soils for recharge, do not fill rapidly. It takes many years of wet—along with disciplined groundwater management—to recover from extra pumping during drought.

With megadroughts, less frequent wet years create an overreliance on aquifers and limit the ability to recharge them. Groundwater deficits accumulate, a problem compounded by high evaporative demand during dry, warm years. Nowhere is this more evident than in the San Joaquin Valley, where overdraft jumped dramatically in the past two decades, making it harder to achieve sustainable groundwater management.

Deficits and evaporative demand also affect the state’s fragile freshwater ecosystems and headwater forests. California’s plant and animal communities are adapted to occasional drought, but water and forest management practices have made these communities much more vulnerable. The warm, dry 21st century accelerated declines in freshwater ecosystem health and native biodiversity, and contributed to extensive tree deaths in headwater forests.

The new research on megadrought in the West concludes that roughly half of the current drought is from natural climate variability while the other half is associated with warming trends driven by global climate change.

There are strong indications that this megadrought is a preview of a future that is warmer, with more intense droughts. If so, drought planning and preparation will need to change. A first step would be to place less emphasis on the cool, wet 19th and 20th centuries as a guide to the future. Rather, we should focus on the warm, dry beginning of the 21st century as the new baseline to inform drought adaptation efforts.

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Risk, Resilience, Response
American Society of Civil Engineers | June 2020 | Jay Landers

In accordance with the requirements of the America's Water Infrastructure Act of 2018, U.S. drinking water providers must complete risk and resilience assessments and emergency response plans. Large water utilities had to complete their assessments earlier this year, offering valuable lessons to their smaller counterparts as they seek to prepare their own.

Signed into law on October 23, 2018, the America's Water Infrastructure Act (AWIA) imposed new security requirements for U.S. drinking water systems serving more than 3,300 people. Section 2013 of the AWIA amended the Safe Drinking Water Act to require that such providers conduct a risk and resilience assessment (RRA) to examine risks to their systems "from malevolent acts and natural hazards," according to the law. As part of its RRA, a water provider also must evaluate the resilience of its entire enterprise, from its source water to its distribution system as well as its monitoring, operation and maintenance, and chemical storage and handling practices. Such assessments also are to include a water provider's financial infrastructure and its protection against cyber threats (see the related article: What Must a Risk and Resilience Assessment Include?).

One of the many utilities that had to certify the completion of its risk and resilience assessment by March 31, Davidson Water Inc. operates two drinking water treatment facilities—the 15 mgd Gregg W. Stabler Water Treatment Plant and the 12 mgd C.O. Pickle Water Treatment Plant—in Lexington, North Carolina. (PHOTOGRAPH COURTESY OF DAVIDSON WATER INC.)

These assessments, in turn, are to serve as the basis for the other main requirement of Section 2013 of the AWIA, the development by water utilities of an emergency response plan (ERP). According to the act, the plans must include the following four components:

"strategies and resources to improve the resilience of the system, including the physical security and cybersecurity of the system;
plans and procedures that can be implemented, and identification of equipment that can be utilized, in the event of a malevolent act or natural hazard that threatens the ability of the community water system to deliver safe drinking water;
actions, procedures, and equipment which can obviate or significantly lessen the impact of a malevolent act or natural hazard on the public health and the safety and supply of drinking water provided to communities and individuals, including the development of alternative source water options, relocation of water intakes, and construction of flood protection barriers; and

strategies that can be used to aid in the detection of malevolent acts or natural hazards that threaten the security or resilience of the system."
The law included staggered deadlines for utilities to complete their RRAs and certify to the U.S. Environmental Protection Agency (EPA) that they had done so. Larger systems, defined as those serving 100,000 people or more, had until March 31 to complete this task. These same utilities were given another six months to complete their ERPs. Medium-size utilities have until the end of the year to finalize their RRAs, while smaller utilities have until June 30, 2021. After certification of their RRAs, utilities have six months to develop or update their ERPs. (See the table.) The AWIA also requires that utilities review their RRAs every five years and certify to the EPA that they have done so and have updated their assessments, if necessary.

This drinking water facility in Bakersfield was evaluated as part of the risk and resilience assessments that the California Water Service recently completed for eight of its service areas in the state. (PHOTOGRAPH COURTESY OF CALIFORNIA WATER SERVICE)

Section 2013 of the AWIA amounts to an "update" of the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, commonly known as the Bioterrorism Act, says Kevin Morley, Ph.D., the manager of federal relations for the American Water Works Association (AWWA), of Denver. "It's everything that was in the Bioterrorism Act, plus," Morley says. The key difference between the AWIA and its predecessor is that the Bioterrorism Act "was strictly focused on terrorism" and did not address natural disasters or other possible threats to water utilities, he notes. For its part, the AWIA "maintains a need to focus on malevolent acts, but it also brings in natural hazards," Morley says," because that's what is more likely to cause a utility a problem on any given Sunday."

To illustrate his point, Morley gives the example of a large water utility in the southeastern United States that upgraded its physical security after it had conducted its vulnerability assessment as required by the Bioterrorism Act. "They spent a lot of money on fences, cameras, and access control," he says. "Then they had an F5 tornado. Fences and cameras don't do anything to get you ready for an F5 tornado and what that requires from a preparedness perspective." By contrast, "much of what you do to prepare for a hurricane is transferrable to these other threats," Morley says.

Essentially, the AWIA mandates that water utilities use an "all-hazards approach" when assessing the various threats to their systems, says Will Williams, the associate vice president for asset management in the Atlanta office of Black & Veatch, which has its headquarters in Overland Park, Kansas. Besides the aspects of physical security that were the focus of the

Bioterrorism Act, the AWIA also considers factors related to cybersecurity as well as natural hazards, Williams says.

featured image

The importance of ensuring adequate security against cyber threats is "huge," says Simon Watson, CMRP, the operations and maintenance practice leader for Brown and Caldwell, which has its headquarters in Walnut Creek, California. Increasingly, many water utilities rely on internet-based systems for their customer service processes as well as their operational procedures, particularly as a result of remotely accessing supervisory control and data acquisition (SCADA) systems used to operate treatment systems, pump stations, and the like. "Because we're starting to go to more virtual remote access for those, it opens you up for more cyber hacking," Watson says. "You didn't have that in the older way of doing business." In the past, when a SCADA system displayed an alarm, an operator would have to physically check on the equipment in question. That is not always the case today, Watson says. If an operator receives an alarm, he or she might use an iPad or other device to access the SCADA system and ascertain the problem. "That's another cyber link that's in flux," Watson notes.

An operator views the intake structure at the Big Cottonwood Water Treatment Plant, one of the drinking water treatment facilities owned and operated by Salt Lake City. (PHOTOGRAPH COURTESY OF SALT LAKE CITY DEPARTMENT OF PUBLIC UTILITIES)

The cybersecurity hazard is the "one universal threat to everybody," Morley says. "It is one hundred percent probable that you will experience some type of cyber incident. It may not be catastrophic, but it certainly can be disruptive."

In fact, the cyber threat is what prompted Congress to include in the AWIA the requirement that RRAs assess the "financial infrastructure" of water utilities, meaning their business or enterprise systems, Morley says. "This is about ransomware," he says, referring to a type of malware increasingly used by hackers to prevent users from accessing their systems until they have paid a "ransom" by means of an anonymous online payment service. For this reason, RRAs must assess the integrity of any systems used to manage cyber risks associated with a utility's information technology system as well as its operational technology system (i.e., SCADA system).

With this filtration facility, the California Water Service treats groundwater that is supplied to customers in its East Los Angeles District. (PHOTOGRAPH COURTESY OF CALIFORNIA WATER SERVICE)

Ultimately, cybersecurity is "about risk management, not risk elimination," Morley says. "There are many things that can be done to do some basic blocking and tackling to make it harder to get into that network," he says.

Clearly, water utilities conducting their RRAs must consider a "much broader range of risks" than used to be evaluated as part of similar assessments, says Forrest Gist, P.E., the global technology lead for security in the intelligent solutions practice at Jacobs, which has its headquarters in Dallas. For example, RRAs should also include an analysis of dependency hazards and proximity threats, Gist says. A dependency hazard involves the loss of something that a utility depends upon, while a proximity threat concerns an incident involving a nearby organization or entity that impairs the functions of the water utility. As an example of the latter, Gist posits a scenario in which a chemical plant neighboring a water utility experiences an explosion, fire, or spill. "How does that impact your facility?" he asks.

Common dependency hazards include electrical power, diesel fuel for generators, and chemicals and other products needed as part of the treatment process. "A critical one that's being looked at right now, especially with COVID-19, is loss of staff," Gist says. "How do utilities work around having to have some of their employees shelter in place or work from home?"

In some cases, a dependency hazard may not be readily obvious, Watson says. "Some of the chemicals needed for water treatment may have multiple suppliers, but it's all from only one manufacturer," Watson notes. "It still only comes from one place. That's a challenge. What is the backup plan if you can't get XYZ chemical?"

Because proximity threats pose risks to source water, Congress specifically mandated that source water be evaluated as part of RRAs. In doing so, Morley says, lawmakers were responding to two episodes in 2014 of large-scale contamination of the source water supplying major American cities. The first, in January of that year, involved the spill of a coal-washing chemical into West Virginia's Elk River upstream of the main drinking water intake used to supply the city of Charleston. As a result, about 300,000 people in the Charleston metropolitan area lost access to potable water for several days. In August 2014, a toxic algal bloom in western Lake Erie forced the city of Toledo, Ohio, to warn its residents not to drink or touch the water from their taps for three days.

Population Served	Risk and Resilience Assessment	Emergency Response Plan*
100,000 or more	March 31, 2020	September 30, 2020
50,000 to 99,999	December 31, 2020	June 30, 2021
3,301 to 49,999	June 30, 2021	December 31, 2021

*Emergency response plan certifications are due six months from the date of the risk assessment certification. The dates shown are certification dates based on a utility submitting its risk and resilience assessment on the final due date. Source: U.S. Environmental Protection Agency

Certification Deadlines

In requiring assessments of threats to source water, Congress aimed for utilities to gain better understanding of how to ensure the resilience of these critical resources. "The idea there was [that] there's stuff outside your fence line that can make you have a bad day," Morley says. "You don't have any control over it, but you should evaluate that threat and recognize what the possibility is and understand what you can and can't do." To help utilities better understand potential threats to their source waters, Section 2018 of the AWIA directs states to allow water utilities access to reports prepared as part of Emergency Planning and Community Right To Know Act detailing substances stored in aboveground tanks.

"All of those four threats—malevolent acts, natural hazards, dependency, and proximity—are reviewed in a well-rounded risk assessment," Gist says. However, additional threats need to be considered, depending on the particular situation of an individual utility. For example, Gist cites the case of a client he worked with that assumed its largest threat concerned cybersecurity. However, during the process of developing its RRA, Jacobs and the utility discovered that the imminent retirement of senior staff presented a much more tangible problem. "For them, their biggest threat was loss of staff," Gist notes. "There were one or two people who had a lot of really important information in their head. It wasn't really written down, or if it was, nobody knew where it was written down." As a result, Jacobs recommended that the utility take steps to document the processes used by key staff and implement programs aimed at disseminating the information held by senior staff to others within the organization.

Besides risks, an RRA must address the resilience of a water system's physical and electronic components. The issue of resilience, Gist says, must be examined to answer the question, "How can a utility bounce back after an impact?

Of course, the answers to this question will depend entirely on the individual risk under evaluation. At the same time, responses to certain risks may need to evolve over time as circumstances change. For example, Watson notes that the growing incidence of wildfires in California in recent years has prompted some electric utilities, especially those in the northern portion of the state, to engage in public safety power shutoffs. During such an incident, an electric utility turns off power in areas experiencing strong winds and other conditions that increase fire risk. Because the power now tends to be shut off for longer periods of time compared with past efforts to prevent fires, this has implications for water utilities conducting RRAs, Watson says. "They're having to come up with longer-term mitigations," he explains. "We've had a lot of utilities that are starting to look at putting in more permanent backup power, whereas in the past maybe they had a portable generator they could take around to different areas."

Although Section 2013 of the AWIA specifies the topics to be addressed in an RRA, the law is silent on the process to be used when conducting such assessments. "Utilities are free to use the methodology that they wish, provided they cover the risk topics required under the law," Gist says.

The EPA has developed tools and guidance for use in developing RRAs, including the Vulnerability Self-Assessment Tool (VSAT) designed for assessing risk and resilience at drinking water and wastewater systems. The VSAT is intended for medium- or larger-size utilities. To help smaller utilities comply with the RRA requirements of Section 2013 of the AWIA, the EPA prepared the guidance document Small System Risk and Resilience Assessment Checklist.

Additional material is available to help utilities assess potential threats and hazards and the likelihood of occurrence. For example, the EPA released in 2019 Baseline Information on Malevolent Acts for Community Water Systems, which is intended for use in selecting malevolent threats to be included in an RRA. The U.S. Department of Homeland Security and other law enforcement agencies also have prepared guidance for this purpose.

The "gold standard" method for developing RRAs, Gist says, is spelled out in the 2010 document Risk Analysis and Management for Critical Asset Protection (RAMCAP) Standard for Risk and Resilience Management of Water and Wastewater Systems, which was developed by the AWWA and the American National Standards Institute, of Washington, D.C. Commonly known as the J-100-10 standard, the document describes a seven-step process that "covers all the bases that are needed within the risk and resilience assessment," Gist says. Briefly, the seven steps are:

1. characterizing assets
2. characterizing threats and hazards
3. analyzing the consequences of threats and hazards
4. analyzing vulnerabilities that would allow a threat or hazard to occur
5. analyzing the likelihood of the various threats and hazards
6. assessing a utility's current level of risk and resilience
7. considering options for reducing risks and increasing resilience

By conducting the first six steps of the seven-step process spelled out in the J-100-10 standard, a utility determines the consequences, vulnerabilities, and likelihoods for every threat and asset and multiplies those factors to determine the corresponding risk. "All those previous steps come together in step six, which is a risk analysis developing the actual numbers for each risk," Gist says. "The numbers are listed in risk-dollars per year. It makes it very easy to understand and compare risks."

Armed with this information, a utility identifies ways to reduce those risks during the seventh step. For example, a utility would look to develop "mitigation recommendations, improvement recommendations, and staffing or policy recommendations" to reduce those risks, Gist says. The utility then assesses the recommendations in terms of their benefits and costs and develops a schedule for implementation.

Having a monetized estimate of the annual baseline cost associated with various risks can go a long way toward helping a utility "justify some expenditures for reducing risk," Watson says. He uses the example of a utility that faces a threat having a risk value of $500,000 annually. If utility staff develop a mitigation plan that costs $100,000, the board is able to "see the cost-benefit analysis" and may be more likely to approve the expense, he says. "Board members like to make decisions based on risk and dollars."

In light of these and other methodologies and accompanying guidance documents, the question looms as to which approach is best for a given utility. Seeking to answer this question, the Water Research Foundation—which has offices in Denver and Alexandria, Virginia—undertook Project 5014, Practical Framework for Water Infrastructure Resilience. The ongoing research effort seeks to help utilities "navigate through the maze to find the best way of assessing resilience for their specific circumstances and size," says Black & Veatch's Williams, who is leading the project.

"What we're developing is a framework to help utilities decide on the level of resilience that they intend to put in place," Williams says, "the best balance of performance, cost, and risk that they want to achieve." To this end, the project is intended to help utilities of all sizes and types, not just drinking water providers, understand which guidance or standards would best assist them in these efforts. The goal is to provide utilities with a "decision-making framework" that accounts for such variables as utility type and size and can be used to determine how best to proceed with efforts to develop resilience within their systems, he says.

This framework "will allow water utilities to make the right decisions about how they most efficiently get to the right level of resilience and how that might improve over time," Williams says. In this way, utilities can comply with the requirements of the AWIA but also integrate resilience more deeply into their systems as they move forward.

As part of the research project for the Water Research Foundation, Black & Veatch is working with 20 partners that include small, medium, and large utilities that encompass those providing services related to drinking water, wastewater treatment, or stormwater management. The team is developing a series of case studies and guidance documents that are intended to "raise the profile of the focus on resilience," Williams says. The finished product is scheduled to be completed by the end of this year, he notes.

As an interim measure, the Water Research Foundation and Black & Veatch released in late May AWIA Execution: Lessons Learned , a report that highlights practical guidance distilled from the first round of RRAs completed earlier this year by large utilities. The report includes recommended resources, tips for completing RRAs and ERPs, and suggestions for how to incorporate resilience more fully into utility programs in the future. "We're encouraging utilities to embrace resilience as part of business as usual," Williams says.

In an era when many utilities face significant challenges in addressing aging infrastructure, the idea of having to spend money to increase resilience may prove a tough sell. However, smart organizations will find ways to balance both needs, Williams says. "Utilities need to make sure they have a risk-based planning approach, so [that] they can make sure their next dollar is spent on the most benefit," he says. "The utilities that get the most out of this will be those that

combine programs," by linking their RRAs with other objectives such as their asset management programs, workforce development efforts, or aging infrastructure replacement programs.

The AWWA's Morley agrees. After identifying the risks they face, utilities are better positioned "to do some potentially more directed capital improvement planning," he says. Once aware of a given risk, a utility can seek ways to address it as part of a separate capital program. "I've got this need that was a potential risk when I did my assessment," Morley explains. "So, I can knock that [risk] down a little bit by doing this other capital program. I might be able to kill two birds with one stone."

Additional Insight: WHAT MUST A RISK AND RESILIENCE ASSESSMENT INCLUDE?

California Water Service, which has its headquarters in San Jose, has 23 service areas within the state, including Bakersfield, Stockton, and many smaller cities. Of those service areas, eight serve more than 100,000 people, which necessitated the development of a separate RRA for each of those service areas by the March 31 deadline. "We kind of had to scramble to get everything done for those first eight," says Darin Duncan, P.E., the director of field operations for Cal Water.

Cal Water kicked off its initial work on the RRAs in fall 2019 by evaluating a host of existing reports regarding its facilities. "We looked at our water supply facility master plans, our urban water management plan, and some of our rate case filings and justifications," Duncan says. "We had security reports and emergency response plans. Pretty much all the reports we've done in the past, we put them out there and said, 'Let's take a look at these, and let's try to figure out risk from this.' It was kind of a shotgun approach."

After assessing risks in this broad fashion, Cal Water and its consultant, Brown and Caldwell, interviewed the local operators and management staff of individual systems to vet the information and obtain their input regarding risks. Overall, the RRA process resulted in a better, more complete understanding of smaller-scale, localized risks, rather than "big-picture risks," Duncan says. "We're in California. We're in earthquake country. We have systems that cross the San Andreas Fault. We've known about those risks. We know about the flooding risks."

Instead, the development of the RRAs helped provide greater insight regarding the "individual risks" of each of Cal Water's systems that was the subject of an RRA, Duncan says. For example, an area served by a single pipeline faces the risk of a complete loss of service should something happen to it. Although local operators tended to be aware of such risks, this information had not always been passed along to the corporate level, Duncan says. As a result of the RRA process, Cal Water is better positioned to address these risks. "Now everybody is aware of these major and minor risks to these systems," he notes.

With the information learned from developing the RRAs, Cal Water plans to take steps to reduce the risks. "We're going to work with our public utilities commission to show what we found and go forward and really work to eliminate this risk," Duncan says.

As it developed its RRA in advance of the March 31 deadline, the Salt Lake City Department of Public Utilities benefited from the existence of a previous vulnerability assessment it had conducted in 2003, says Natalie Moore, P.E., an engineer for the department. "We used that to

assess the gaps between that study and the AWIA requirements," Moore says. "We looked for the gap and then, obviously, tried to fill in some of those things that we needed to update." To this end, the department used master plans that had been developed for individual water treatment plants, as well as a 2019 drought contingency plan. "There was a lot of information about some natural waterways and some of our mitigation efforts for drought that were helpful," she says. "We had a range of studies that we tried to glean some information from to help us with the RRA."

Working with Jacobs, the Salt Lake City Department of Public Utilities developed its RRA in a "pretty straightforward" manner, Moore says. "Jacobs laid out the pathway well." However, a significant amount of staff time was required to conduct the RRA, Moore notes. "It was a huge time dedication. We had twenty or thirty staff members in the room for half-day or all-day workshops and meetings." Staff were present to provide input on various aspects of the department's systems. Site visits to certain critical facilities also were held. "Organizing all the staff and finding time for everybody to participate was [the] most difficult but most important part," Moore says.

Although difficult, having the proper staff present for key discussions related to the RRA process is critical to ensuring success, Moore maintains. "It was most helpful to have the right staff in the room," she says. "We had everybody from customer service to billing to operations and management." In some cases, staff members were able to relay important information that was not widely known outside their immediate realms. "It's really helpful to get everybody at the table talking," Moore says.

Cal Water's Duncan concurs. "Make it a multidepartment, multidiscipline effort," he says. "Make sure you have your systems engineers who have different concerns from water quality people who have different concerns from operators. You get all those groups together, and you can really do well."

To help utilities with the preparation of their ERPs, the EPA published in July 2019 Community Water System Emergency Response Plan: Template and Instructions. The template is organized in a manner that helps utilities ensure that they have included all the information necessary to comply with the AWIA's requirements pertaining to ERPs. Such information includes details regarding resilience strategies, emergency plans and procedures, mitigation actions, and detection strategies.

Davidson Water Inc., of Welcome, North Carolina, is a private nonprofit membership cooperative that provides drinking water for about 150,000 people in Davidson County and portions of Randolph and Forsyth Counties. In summer 2019, Davidson Water hired Merrick and Company, of Greenwood Village, Colorado, to develop its RRA and ERP. For these tasks, Merrick brought onboard two subconsultants: Enterprise Management Associates Inc., of Boulder, Colorado, for cybersecurity and iParametrics LLC, of Alpharetta, Georgia, for facility security.

Although a security committee within Davidson Water has worked over the years to update its emergency response procedures, "we've needed to do a deeper dive," says Robert Walters, the vice president of construction and engineering for Davidson Water. "That's why I'm excited to

see what the consultant will bring to us" for the ERP due on September 30, Walters says. "I want it to be more user-friendly, if you will."

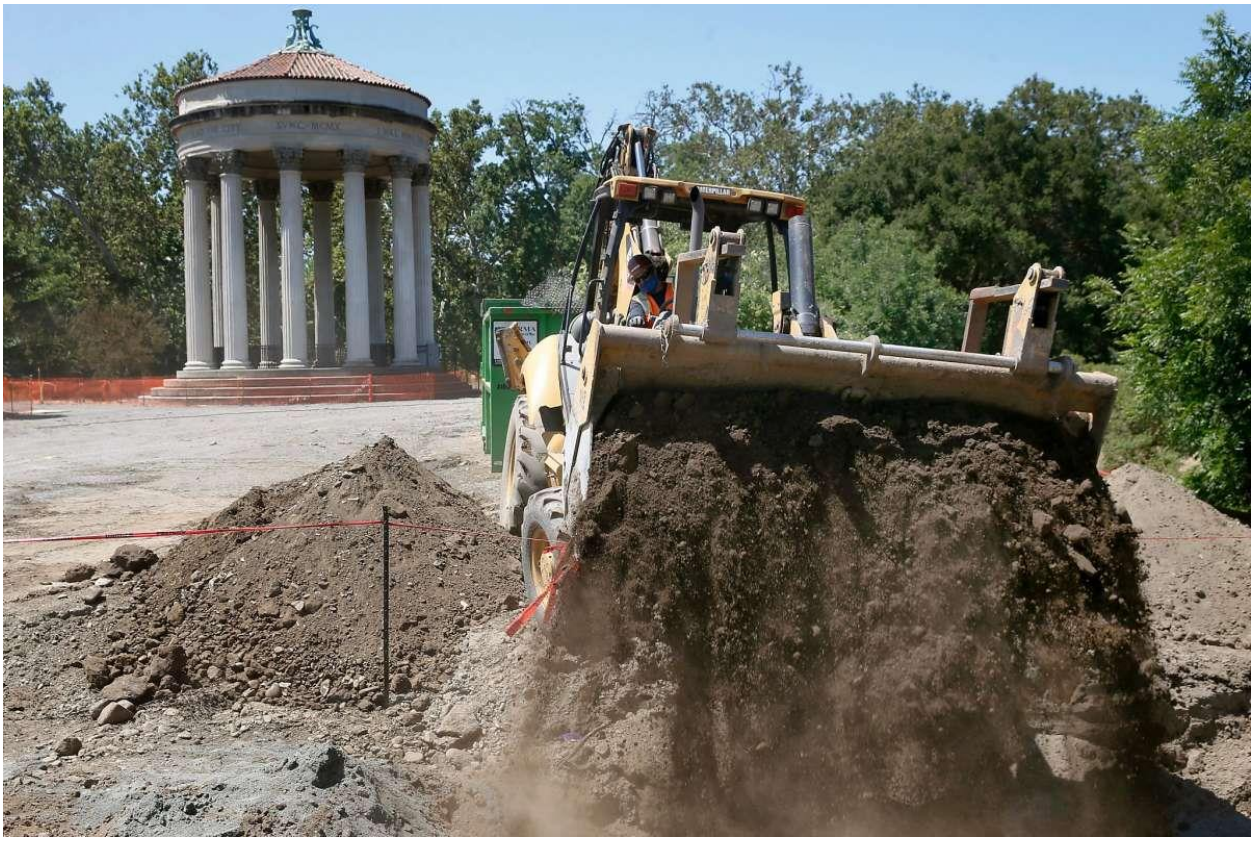
To this end, as part of the overall ERP, Walters intends for Davidson Water to prepare small "flip books" that describe how operators and other staff should respond in the face of certain relatively common emergencies such as tornadoes or ice storms. Unlike a large manual, the small flip books could be kept by staff in their vehicles or other convenient locations and retrieved as necessary. The flip books would offer quick guidance on the steps to take, preparations to be made, and people to contact in the event of a given incident, Walters says. "That's what I mean by a user-friendly kind of thing."

In its own small way, the example from Walters highlights the ultimate goal of the AWIA—helping ensure that water utilities run as smoothly as possible, even in the event of hazards both likely and unlikely.

# # #

Jay Landers is a contributing editor to Civil Engineering.

SF commission breaks ground on nature center near Sunol to spotlight its water
San Francisco Chronicle | June 26, 2020 | Kurtis Alexander



Excavated dirt is unloaded in front of the Sunol Water Temple as construction on the Alameda Creek Watershed Center gets under way near Sunol.

San Francisco's water department, known for sourcing some of the best supplies in the West, including the bounty of Yosemite National Park, is building its first nature center to commemorate its watersheds.

The $27 million facility, which broke ground this spring, is taking shape on city-owned land in Alameda County, near the town of Sunol. The center is designed to extend the tribute paid by the Sunol Water Temple, a 110-year-old monument honoring local creeks, with 10,000 square feet of exhibits and education space that tell the story of the area and of San Francisco water.

Building such a center has been a goal of the San Francisco Public Utilities Commission for at least two decades. The city agency, which manages 61,000 acres of real estate from the coastal hills to the Sierra, sees itself not only as a manager of water and wastewater but a steward of the land. Only after years of trying to secure money and support did the vision of showcasing its watersheds move forward.

“We’ve been incrementally trying to open doors and be a better steward and better neighbor,” said Tim Ramirez, head of the SFPUC’s natural resources and lands division. “We’ve always wanted to play a more prominent role.”

The rural area where the planned Alameda Creek Watershed Center is located is the SFPUC’s largest land holding, at more than 38,000 acres, and an important source of agency water. The grasslands and oak woodlands that spread across both Alameda and Santa Clara counties contain several waterways and two reservoirs, the San Antonio and Calaveras.

The facility’s exhibits will highlight the ecology of this site, with an 8,000-gallon aquarium replicating a streambed and containing live rainbow trout, an interactive projection wall identifying local flora and fauna, and a science lab that caters to school groups.

The building itself seeks to embody the landscape, with displays arranged along a walking course that meanders like a creek and big windows that seize on views of adjacent gardens and woods.

“You feel like you’re in the (riparian) corridor and the canyon,” Ramirez said.

The significance of the watershed to the SFPUC’s larger mission will also be a theme.

The agency supplies water not only to San Francisco but more than two dozen communities in Alameda, Santa Clara and San Mateo counties. It serves more than 2.7 million people.

Most of the supplies come from Hetch Hetchy Reservoir in Yosemite National Park, one of the nation’s most pristine sources of municipal water. San Francisco secured water rights to the park land more than a century ago, a move that remains controversial to this day. Some believe the reservoir should be restored to the natural valley it once was.

The San Antonio Reservoir in Alameda County often stores water piped in from Hetch Hetchy.

The watershed center also will honor the area’s cultural past. Exhibits will feature the history of the Muwekma Ohlone, the Native Americans who first inhabited the area and who have been helping design displays at the interpretive center.

Interest in spotlighting the Ohlone heightened two years ago when an excavation of the land around the center yielded the remains of 67 tribal members and more than 13,000 artifacts, from arrowheads to grinding bowls.

“It became evident that we needed to change the exhibit to reflect the significance of the site,” said Carla Schultheis, the SFPUC’s watershed and environmental improvement program coordinator.

While much of the surrounding land is closed to the public to protect the watershed, the center's grounds are expected to eventually offer trails that lead to areas managed by the East Bay Regional Park District, including the Vargas Plateau.

Residents of the area see the project as a source of recreation as well as a potential point of pride, like the nearby Niles Canyon Railway, a living museum that celebrates railroad history.

"Sunol is a small town, so having something like this gives us a place to go, an opportunity," said Connie De Grange, chairwoman of the Sunol Citizens Advisory Council.

Construction of the center is scheduled to be completed by spring of 2022. The facility is expected to open shortly thereafter.

SFPUC officials say the cost of the project, out of the agency's roughly $1 billion annual budget, is a small price to pay for the recreational benefit, educational outreach and conservation message.

The water agency has taken up a handful of similar community initiatives, including a demonstration garden in San Francisco's Bernal Heights and an urban farm in the city's Crocker Amazon Park.

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