

**BAY AREA WATER SUPPLY AND CONSERVATION AGENCY
BOARD OF DIRECTORS MEETING**

March 10, 2023

Correspondence and media coverage of interest between February 7, 2023 and March 9, 2023

Correspondence

From: Nicole Sandkulla, BAWSCA CEO/General Manager
To: The Hon. Kevin Mullin, Congressman
Date: March 9, 2023
Subject: Fiscal Year 2024 Appropriations – Congressionally Directed Spending Request

From: Nicole Sandkulla, BAWSCA CEO/General Manager
To: The Hon. Alex Padilla, US Senator
Date: March 9, 2023
Subject: Fiscal Year 2024 Appropriations – Congressionally Directed Spending Request

From: Nicole Sandkulla, BAWSCA CEO/General Manager
To: The Hon. Dianne Feinstein, US Senator
Date: March 9, 2023
Subject: Fiscal Year 2024 Appropriations – Congressionally Directed Spending Request

From: Steven Ritchie, SFPUC Assistant General Manager, Water Enterprise
To: SFPUC Wholesale Customers
Date: March 1, 2023
Subject: Water Supply Availability Update

Press Release

From: Department of Water Resources
Date: February 22, 2023
Press Release: DWR Announces Modest Increases in State Water Project Allocation

From: Hanson Bridgett, LLP
Date: February 15, 2023
Press Release: Governor Newsom Issues Executive Order to Enhance Water Supply Resilience Amid Extreme Hydrologic Conditions

From: Office of Governor Gavin Newsom
Date: February 13, 2023
Press Release: Governor Newsom Signs Order to Build Water Resilience Amid Climate-Driven Extreme Weather

Media Coverage

Water Supply Conditions:

Date: March 8, 2023
Source: Ag Alert
Article: Despite storms, water challenges persist

Date: March 5, 2023
Source: KTVU Fox 2
Article: Half of California out of official drought status, confirms snow survey

Date: March 2, 2023
Source: NBC Universal
Article: See How California's Drought Conditions Improved After a Wet February

Date: March 2, 2023
Source: Fresno State News
Article: Water experts explain what large snowpack levels mean for the Valley

Date: February 25, 2023
Source: San Francisco Chronicle
Article: Here's how this week's winter storms added to California's booming snowpack

Date: February 22, 2023
Source: LA Times
Article: With all this rain and snow, can California really still be in a drought? Look Deeper

Date: February 22, 2023
Source: NBC Universal
Article: What to Know: How California Decides If We're in a Drought

Date: February 21, 2023
Source: USA Today
Article: Before and after photos show recovery at drought-stricken California reservoir

Water Supply Management:

Date: February 22, 2023
Source: CNBC
Article: California water officials raise State Water Project allocation after storms

Date: February 22, 2023
Source: Maven
Article: Reclamation announces initial 2023 water supply allocations for Central Valley Project Contractors

Date: February 5, 2023
Source: San Francisco Chronicle
Article: San Francisco's Hetch Hetchy water system is almost full for the first time in years. Is that A good thing?

Water Infrastructure:

Date: February 27, 2023
Source: CalMatters
Article: This reservoir on the Sacramento River has been planned for decades. What's taking so long?

Date: February 24, 2023
Source: Office of Governor Newsom
Article: 6 Ways California is Capturing & Storing Water from Storms

Water Infrastructure:

Date: February 24, 2023
Source: WaterWorld
Article: EPA announces 100th WIFIA loan to Santa Clara County

Date: February 22, 2023
Source: East Bay Times
Article: Anderson Dam retrofit project receives big federal loan; troubled Pacheco Dam project Remains in limbo

Water Policy:

Date: February 22, 2023
Source: Press Democrat
Article: California water board waives Delta rules that protect salmon

Date: February 14, 2023
Source: CalMatters
Article: Newsom Suspends environmental laws to store more Delta water

Environmental Study:

Date: February 27, 2023
Source: UC Santa Cruz
Article: Shrinking age distribution of spawning salmon raises climate resilience concerns

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March 9, 2023

The Hon. Kevin Mullin, Congressman
U.S House of Representative
1404 Longworth House Office Building
Washington, D.C. 20515

Re: Fiscal Year 2024 Appropriations – Congressionally Directed Spending Request

Dear Representative Mullin,

The City of Burlingame is requesting Congressionally Directed Spending by way of Fiscal Year 2024 Appropriations legislation to support its development of recycled water. Specifically, the City of Burlingame desires funding to prepare a wastewater reclamation facility and infrastructure planning study. The effort has broad local and regional support, and federal funding will be leveraged with local resources, resulting in important public benefits. This study will allow the City of Burlingame to research the feasibility of converting wastewater into reclaimed water, which could greatly reduce the consumption of potable water and better protect residents and businesses from drought conditions.

The Bay Area Water Supply and Conservation Agency (BAWSCA) is a special district that provides regional water supply planning, water resource development, and conservation program services to enhance the reliability of the 16 cities, 8 water districts, and 2 private water providers that supply water to over 1.8 million people and over 40,000 commercial, industrial, and institutional accounts in Alameda, Santa Clara, and San Mateo counties. Several of BAWSCA's member agencies have, as part of their operations, existing and planned recycled water facilities.

BAWSCA is pleased to support the City of Burlingame's request. Increased use of reclaimed water helps to reduce the demand for potable water from other sources. The project, when completed, would align with BAWSCA's Long Term Reliable Water Supply Strategy, which includes supporting our member agencies in their efforts to develop the use of local water supply resources.

I urge you to give all due consideration to the City of Burlingame's request, and I look forward to working with you as Congress proceeds with the annual federal budget process.

Sincerely,

A handwritten signature in blue ink that reads "Nicole Sandkulla". The signature is fluid and cursive, with the first name "Nicole" being more prominent.

Nicole Sandkulla
CEO and General Manager

cc: Ann O'Brien-Keighran, BAWSCA Board of Directors

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March 9, 2023

The Hon. Alex Padilla, Senator
United States Senate
112 Hart Senate Office Building
Washington, D.C. 20510

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Nicole Sandkulla
CEO/General Manager

cc: Ann O'Brien-Keighran, BAWSCA Board of Directors

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March 9, 2023

The Hon. Dianne Feinstein, Senator
United States Senate
331 Hart Senate Office Building
Washington, D.C. 20510

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Nicole Sandkulla
CEO/General Manager

cc: Ann O'Brien-Keighran, BAWSCA Board of Directors

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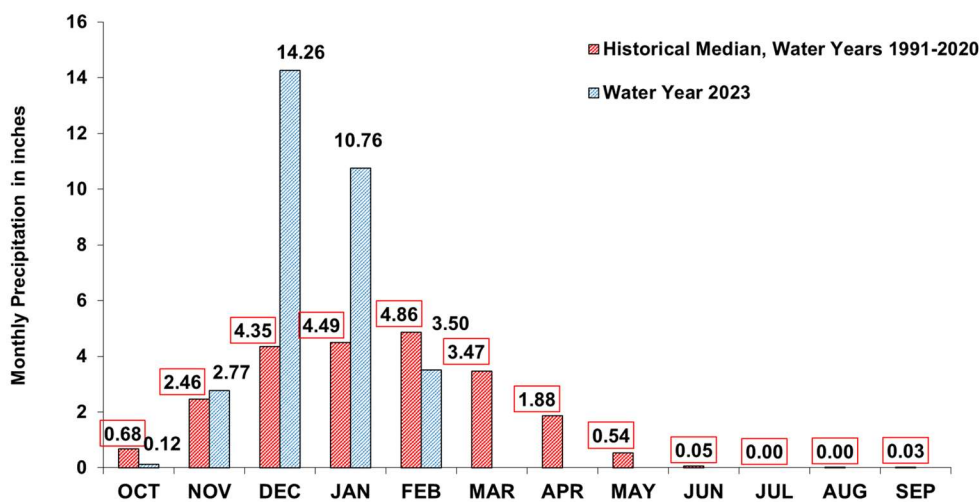


TO: SFPUC Wholesale Customers
FROM: Steven R. Ritchie, Assistant General Manager, Water
DATE: March 1, 2023
RE: Water Supply Availability Update

This memo provides the water supply availability update for Water Year 2023 and the current hydrologic conditions.

While the month of February was appearing somewhat dry, precipitation in the last week and the current storm are expected to bring February totals to at or above average. As the charts below show, both the Hetch Hetchy watershed and the local watersheds are well above normal precipitation to date. The Bay Area 7 Stations total precipitation so far this year is 31.41 inches or 137.75% of normal annual total. The Upcountry 6 Stations total precipitation is 40.98 inches which is 111.72% of normal annual total. Hetch Hetchy precipitation is 39.98 inches for this Water Year, or 174% of median-to-date. The first snow survey of the season performed in early February indicated a snowpack well above median to date. The results of our second snow survey have not been performed due to weather but low elevation snow sensors indicate above median conditions at about 160% of April 1st snowpack.

Bay Area 7-station Precipitation Index as of February 26, 2023



London N. Breed
Mayor

Newsha K. Ajami
President

Sophie Maxwell
Vice President

Tim Paulson
Commissioner

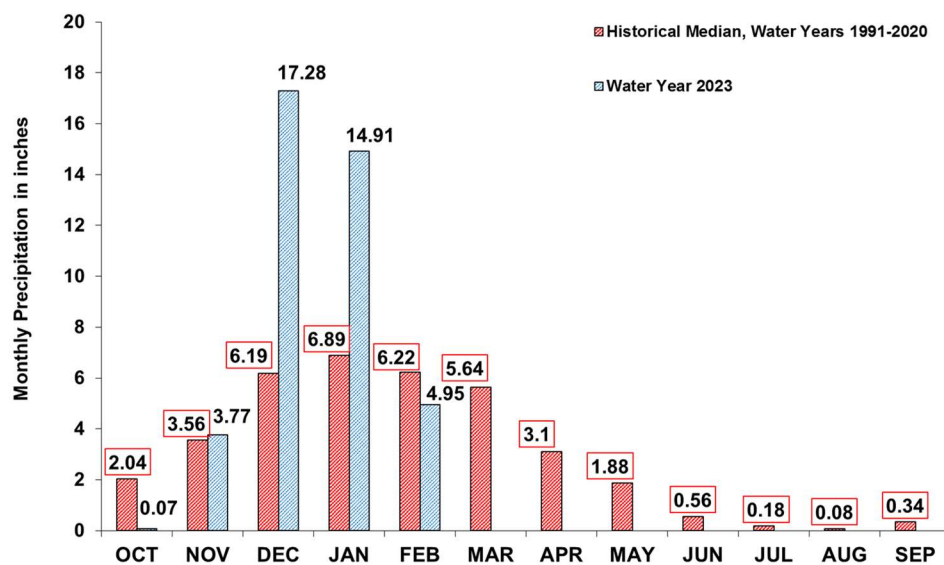
Anthony Rivera
Commissioner

Kate H. Stacy
Commissioner

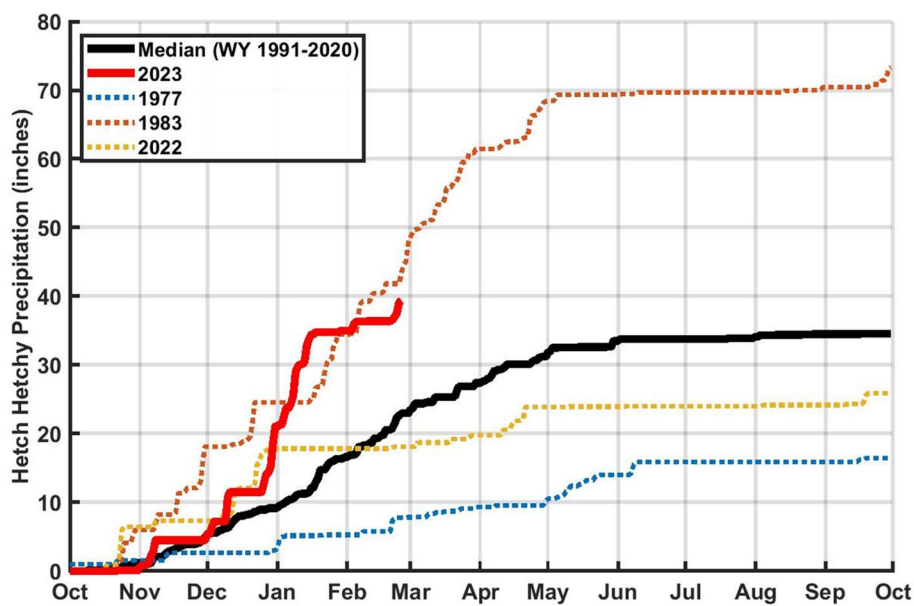
Dennis J. Herrera
General Manager



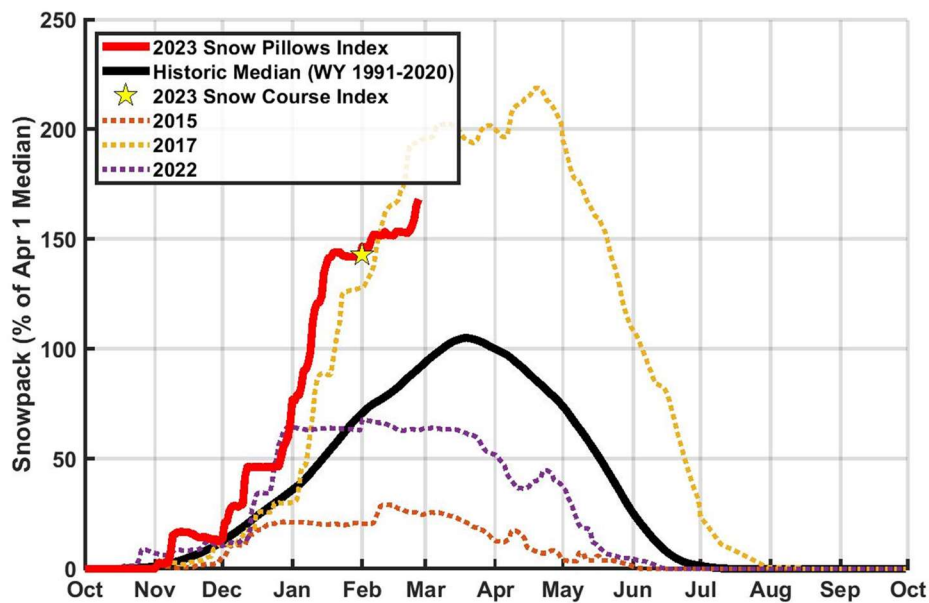
Upcountry 6-station Precipitation Index as of February 26, 2023



Hetch Hetchy Precipitation as of February 27, 2023



Upcountry Snowpack as of February 26, 2023



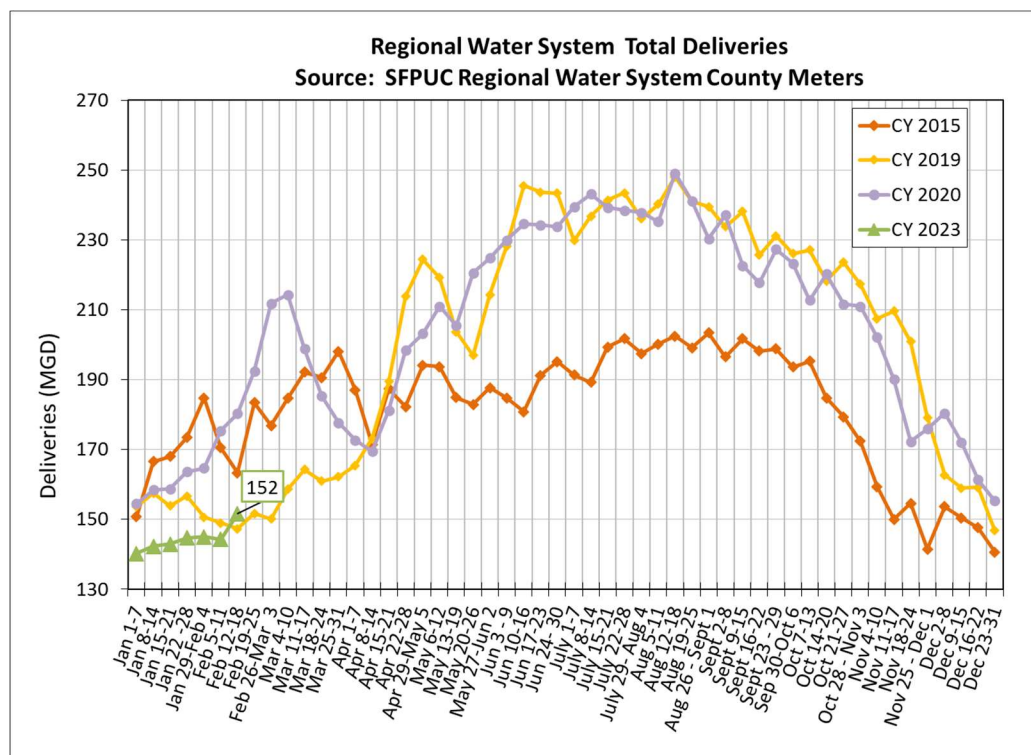
Total System Storage is at 1,295 TAF or 88% of capacity while the median for this day is 80.7% of capacity. Hetch Hetchy storage is at 287.1 TAF or 79.7% of capacity while the median for this day is 66.1% of capacity. Storages are generally above median conditions due to the Mountain Tunnel shutdown and high inflows earlier in the Water Year.

Storage as of: **27-Feb-2023**

Reservoir	Current Storage ^{1,2,3} (AF)	Maximum Storage ⁴ (AF)	Available Capacity (AF)	Percent of Maximum Storage	Normal Percent of Maximum Storage ⁵
<u>Tuolumne System</u>					
Hetch Hetchy	287,100	360,360	73,260	79.7%	66.1%
Cherry	203,900	273,345	69,445	74.6%	-
Eleanor	19,890	27,100	7,210	73.4%	-
Water Bank	570,000	570,000	0	100.0%	99.8%
Total Tuolumne Storage	1,080,890	1,230,805	149,915	87.8%	-
<u>Local System</u>					
Calaveras	90,362	96,670	6,308	93.5%	-
San Antonio	52,319	53,266	947	98.2%	-
Crystal Springs	52,771	68,953	16,182	76.5%	-
San Andreas	16,062	18,572	2,510	86.5%	-
Pilarcitos	2,599	3,125	526	83.2%	-
Total Local Storage	214,113	240,586	26,473	89.0%	-
Total System Storage	1,295,003	1,471,391	176,388	88.0%	80.7%
Total without water bank	725,003	901,391	176,388	80.4%	-

The extremely wet conditions in December and January and the existing snowpack have given confidence that Regional Water System will fill this year. The second snow survey and final snow survey at the end of March will confirm snowpack conditions and boost the certainty of system refill. However, while curtailments continue to be suspended on the Tuolumne River, the possibility of curtailments being reinstated in this Water Year are real and could affect the ability to refill the entire water system. The SFPUC continues to analyze the effects of potential curtailment reinstatement in making operational decisions.

At this time, while the SFPUC is not making any requests for additional water demand reductions beyond the voluntary systemwide 11 percent reduction, until we have certainty of system refill and have a better understanding of the State's intentions regarding its emergency drought declarations, the SFPUC cannot ensure lifting these demand reduction requests at this time. Notably, as the chart shows below, the wet weather has kept demands throughout the service area low. Current systemwide reductions are provided in the table below. The SFPUC will issue a final water supply availability memo in early April following the last snow survey of the year.



For the Period July 1, 2022 - February 18, 2023			
CUSTOMER GROUPS	FY2019/2020 AVG. MGD	FY2022/2023 AVG. MGD	% REDUCTION
San Francisco Customers	64.0	55.3	13.6%
Wholesale Customers	135.5	121.5	10.3%
TOTAL	199.5	176.9	11.4%



CALIFORNIA DEPARTMENT OF WATER RESOURCES

DWR Announces Modest Increase in State Water Project Allocation

Published: Feb 22, 2023



A drone provides a view of water pumped from the Harvey O. Banks Delta Pumping Plant into the California Aqueduct at 9,790 cubic feet per second after January storms. Photo taken January 20, 2023.

SACRAMENTO, Calif. – The Department of Water Resources (DWR) today announced a modest increase in forecasted State Water Project (SWP) deliveries this year due to early gains in the Sierra snowpack. DWR now expects to deliver 35 percent of requested water supplies, up from 30 percent forecasted in January, to the 29 public water agencies that serve 27 million Californians. That would translate to an additional 210,000 acre-feet of water.

Record-breaking atmospheric rivers that pounded the state in January gave way to a mostly dry February that saw less than an inch of precipitation statewide to this point.

“We’re hopeful that more storms this week are a sign that the wet weather will return, but there remains a chance that 2023 will be a below average water year in the northern Sierra.” said DWR Director Karla Nemeth. “Careful planning and the use of advanced forecasting tools will enable the Department to balance the needs of our communities, agriculture, and the environment should dry conditions continue this spring and into next year.”

The SWP will continue to optimize water storage in Lake Oroville to support environmental needs in the summer and allow for carryover storage for next year if the spring becomes extremely dry. Additionally, the forecasted allocation could be adjusted back down if extreme dry conditions warrant.

The 35 percent allocation forecast announced today takes into account snowpack and reservoir storage from those storms, current hydrology conditions, spring runoff forecasts, and an anticipation of dry conditions ahead. The updated SWP forecast is on par with the Central Valley Project (CVP) initial allocations announced today by the U.S. Bureau of Reclamation.

In addition to optimizing water storage, California continues to accelerate investments in habitat restoration, including \$52 million in grants announced last week to help restore and protect fish and wildlife habitat throughout California.

Today's updated SWP delivery forecast takes into account new snowmelt runoff data, known as Bulletin 120. This report provides a forecast of snowmelt runoff and is a key tool for water managers across the state to understand how the melting snow in the Sierra Nevada will reach streams, rivers and eventually California reservoirs. Bulletin 120 offers a range of possibilities to allow water managers to prepare for spring runoff and eventual summer water supply. The forecast is updated regularly throughout the winter and spring.

DWR uses advanced forecasting tools that include Airborne Snow Observatory (ASO) surveys which are now underway to collect snow measurements farther upslope of the Sierra Nevada. The data from these flights, which use LiDAR and spectrometer technology to measure snowpack across broad swaths of key watersheds, is used by DWR to get a more accurate account of California's snowpack and possible spring runoff.

More than a month still remains in the state's wet season, but there's uncertainty about a return to warm and dry conditions prior to April 1, typically when the state's snowpack peaks and begins to melt. DWR is scheduled to conduct the next two snow surveys at Phillips Station on March 1 and April 3. Dates are subject to change depending on weather conditions and DWR will provide updates as the date approaches.

Conditions in the Colorado River Basin and California's groundwater basins continue to have an impact on available water supply. Californians should continue to use water wisely to help the state adapt to a hotter, drier future.

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Contact:
Ryan Endean, Public Affairs
Department of Water Resources
media@water.ca.gov

Governor Newsom Issues Executive Order to Enhance Water Supply Resilience Amid Extreme Hydrologic Conditions

February 15, 2023

On February 13, 2023, Governor Newsom signed Executive Order N-3-23 (the "Order"), which aims to enhance water supply resilience in the state by: (1) directing the State Water Resources Control Board ("Board") to consider modifications to State Water Project ("SWP") and Central Valley Project ("CVP") water right permit conditions in order to enable additional water storage; (2) suspending compliance with the California Environmental Quality Act ("CEQA") for such approvals; and (3) continuing the Governor's CEQA exemption for groundwater recharge projects to the extent necessary to address drought impacts.

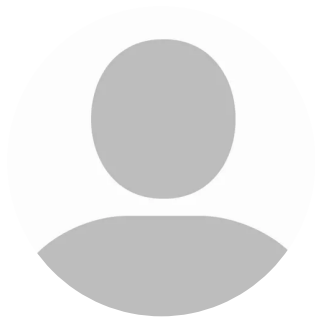
First, the Order provides that the Board shall consider modifying requirements for reservoir releases or diversion limitations in SWP and CVP project facilities to ensure there are adequate water supplies for purposes of health, safety, the environment, or drought resilient water supplies including "supplies both north and south of the Delta." As the state has experienced an extremely wet water year to-date, yet began the year with many reservoirs near all-time lows, pressure has grown to conserve stored water earlier in the year.

On the same day the Order was issued, the United States Bureau of Reclamation and the California Department of Water Resources filed Temporary Urgency Change Petitions with the Board seeking to modify water quality conditions for their water rights, including moving a salinity compliance point in the Delta known as "X2" farther east through March, would allow the projects to conserve up to 700,000 acre-feet of water in storage. The Order suspends CEQA compliance for Board approval of such actions.

The Order also continued prior Executive Order N-7-22, issued on March 28, 2022, which among other things suspended CEQA with respect to groundwater recharge projects to the extent necessary to address drought impacts.

Notably, the Order also directs state agencies to advise the Governor, no later than April 28, of recommendations for further actions necessary for drought response, including whether any existing provisions are no longer needed.

For More Information, Please Contact:



David Cameron

Partner

Sacramento, CA

Areas of Focus

[Water Law](#)



Governor Newsom Signs Order to Build Water Resilience Amid Climate-Driven Extreme Weather

Published: Feb 13, 2023

SACRAMENTO – Governor Gavin Newsom today signed an executive order to protect the state’s water supplies from the impacts of climate-driven extremes in weather. After years of prolonged drought, recent storms resulted in the wettest three-week period on record in California. The storms have been followed by an unseasonably dry February, however, and the state could see a return to warm and dry conditions during the remaining weeks of the wet season – just as heavy rains in fall 2021 gave way to the driest January-February-March period in over 100 years.

While recent storms have helped replenish the state’s reservoirs and boosted snowpack, drought conditions continue to have significant impacts on communities with vulnerable water supplies, agriculture, and the environment. The latest science indicates that hotter and drier weather conditions could reduce California’s water supply by up to 10% by the year 2040.

The frequency of hydrologic extremes that is being experienced in California demonstrates the need to continually adapt to promote resiliency in a changing climate. To protect water supply and the environment given this new reality, and until it is clear what the remainder of the wet season will hold, the executive order includes provisions to protect water reserves, and replace and replenish the greater share of rain and snowfall that will be absorbed by thirstier soils, vegetation and the atmosphere.

The order helps expand the state’s capacity to capture storm runoff in wet years by facilitating groundwater recharge projects. It also continues conservation measures and allows the State Water Board to reevaluate requirements for reservoir releases and diversion limitations to maximize water supplies north and south of the Delta while protecting the environment. Additionally, the order directs state agencies to review and provide recommendations on the state’s drought response actions by the end of April, including the possibility of terminating specific emergency provisions that are no longer needed, once there is greater clarity about the hydrologic conditions this year.

The text of the executive order can be found [here](#).

Leveraging the more than \$8.6 billion committed by Governor Newsom and the Legislature in the last two budget cycles to build water resilience, [the state is taking aggressive action](#) to prepare for the impacts of climate-driven extremes in weather on the state’s water supplies. In the 2023-24 state budget, Governor Newsom is proposing an additional \$202 million for flood protection and \$125 million for drought related actions.

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Despite storms, water challenges persist

Ag Alert | March 8, 2023 | Christine Souza



New snow blankets the landscape of Shasta Lake, California's largest reservoir. Last week, California water officials announced that the statewide Sierra Nevada snowpack was recorded at 190% of seasonal average on March 3. Meanwhile, at a water conference, state officials warned they expect warming conditions to persist and called for partnering on water supply solutions.

As still more storms dumped new snow onto California's burgeoning snowpack, water managers, farmers and environmentalists gathered in Sacramento last week to discuss long-term challenges to secure a more certain water future.

The fresh snowfall contrasted with challenging water realities discussed at the 61st California Irrigation Institute Annual Conference. With a theme of "One Water: Partnering for Solutions," the event focused on addressing impacts of climate change, including warming conditions and frequent droughts that severely diminish the snowpack and state water supplies.

The gathering emphasized solutions that some speakers said could be aided through partnerships among different water interests.

“We’ve certainly adopted a one water approach, and that really is breaking down the silos within our own utility and then taking that same approach as we think about building partnerships outside of the utility,” said Paula Kehoe, San Francisco Public Utilities Commission director of water resources. “We recognize that there’s definitely opportunities, but it takes a lot of hard work. There are many solutions to our challenges.”

In describing the state’s “hotter, drier new normal,” Karla Nemeth, director of the California Department of Water Resources, which operates the State Water Project, said the state’s water supply is much improved since last December.

Lake Shasta, California’s largest reservoir, was framed by heaps of snow last week. Its water level as of Monday had risen to 83% of historical average. But Nemeth warned that the state’s hydrology is variable, and snow levels in some regions are below average.

“The snowpack is much more intense in the central and southern Sierra, less so in the northern part of the country,” Nemeth said. “In fact, we’re a little bit below average. These storms may push us over that, which would be terrific, but what is important is the northern part of the state is where we have our biggest reservoirs that feed both the state and federal water projects, which is really a backbone of water management here in California.”

Prior to the last few weeks of storms, she said, California had less than an inch of rain from late January to the first two weeks of February. “When it’s not raining, it’s actually getting drier, and that really represents a shift over our observed hydrology over the past hundred years.”

Warmer temperatures, Nemeth said, have water managers looking at the amount of water lost to evapotranspiration.

“We need to develop and appreciate the actual growing sliver of water that is either sinking into the soil or is evaporating given the role of temperature,” she said.

DWR is also focusing on forecasting improvements and looking at soil moisture modeling to better understand how much water can be counted on from storms following dry conditions, Nemeth said.

As part of a panel discussion, Sacramento Valley farmer Fritz Durst discussed his approach to sustainable farming, including the use of no-till and other soil-health practices that retain water and improve yields.

Durst, who grows mainly dryland crops, said “the climate change we’re seeing today has really added a substantial amount of risk” to farming.

“We’re seeing much warmer temperatures in the summertime and colder temperatures in the winter,” said Durst, who farms rice, alfalfa, sunflowers, tomatoes and cereal crops near Knights Landing and is a Sacramento River settlement contractor.

By farming sustainably, Durst said, he uses water to benefit wildlife and fish, and he is able to make a profit.

“We’ve been very proactive in the Sacramento Valley, especially in the rice realm, where besides providing food for human beings, we provide food for shorebirds and waterfowl,” he said. “We provide food for fingerling salmon, and we have a plethora of different types of mammals and reptiles living around our fields. We’re trying to help not just ourselves but the environment we live in.”

Nemeth said water management must emphasize the “need to share the resource, so that we can continue to thrive both economically and environmentally.” She said it is important for water managers to add flexibility to the water system.

To respond to changing conditions, she said, investments must be made in construction of aboveground and belowground water storage, desalinization and water recycling.

Local agencies are working on groundwater recharge and demand management to comply with the Sustainable Groundwater Management Act, a 2014 law that requires efforts to bring depleted groundwater basins into balance.

Jeevan Muhar, general manager of the Arvin-Edison Water Storage District, a federal Central Valley Project contractor based in Kern County, said it is important to invest in construction of new infrastructure and repairs of existing conveyance facilities.

Touting partnerships between agencies as a path to water-management solutions, Muhar described the cooperative relationship the water district enjoys with the large water provider in neighboring Los Angeles County.

“One of our largest partners is the Metropolitan Water District,” he said. “We were one of the first ag-urban partnerships, and I’m proud to say that we continue to have that partnership.

“Talk to your neighbors. Your neighbors might already have those facilities, and you should be able to capitalize on what folks are doing around you,” Muhar added. “I definitely encourage you to think outside the silos and break those down. We have to.”

Working collaboratively with various interests, he said, his district is trying to solve problems, noting that there are “some synergies in working with flood plains and recharge and solving water quality problems all at the same time, so that we can move forward and not continue to fight.”

Robyn Grimm, climate resilient water systems director for the Environmental Defense Fund, discussed work with local partners to develop tools, systems and approaches to manage water and land resources.

“Ultimately, all of us in the room here, we’re trying to get to the same place where our water systems are in balance, and we’re using our water supplies in a way that results in a sustainable and resilient California with ongoing agricultural production, beautiful places to recreate, a strong economy and a healthy environment,” Grimm said. “It is a big lift to get there, and change is really hard, and the system is ever evolving and changing. We need to trust one another and work together.”

#

Half of California out of official drought status, confirms snow survey

The most recent Sierra Snow Survey shows that the snowpack is almost double the average for this time of year. That supports the U.S. Drought Monitor's latest report showing less than half the state in drought.

KTVU Fox 2 | March 5, 2023 | Tom Vacar

PHILLIPS STATION, Calif. - The Sierra Snow Survey confirms why half of California is already out of official drought status and is on its to adding a lot more, if not the whole state. It may not be time to take a victory lap, but after Friday's snow survey, you can see we're coming up on the checkered flag ahead.

Friday's March snow survey, just off Highway 50 at Phillips Station, was originally scheduled for last Wednesday but Consulting Meteorologist and Professor Jan Null says that became impossible yet a good omen.

"They had to put off the measurement day by a couple of days so they could get access to the site because there's so much snow up there," said Null.



File: Phillips Station, one of the snow survey sites.

(Kenneth James / California Department of Water Resources / FOX Weather)

Statewide snowpack almost double the average

That's already far more than what would be the historical average in April; the historical peak of snowpack measurements.

"Our statewide snowpack is sitting at 190% of average as of this morning," said California Snow Survey & Water Supply Manager Sean de Guzman.

More rain and snow are on the way.

Data For: 03-Mar-2023

% Apr 1 Avg. / % Normal for this Date



NORTH

Data For: 03-Mar-2023

Number of Stations Reporting 29
Average snow water equivalent 39.8"
Percent of April 1 Average 136%
Percent of normal for this date 151%

CENTRAL

Data For: 03-Mar-2023

Number of Stations Reporting 49
Average snow water equivalent 46.7"
Percent of April 1 Average 175%
Percent of normal for this date 196%

SOUTH

Data For: 03-Mar-2023

Number of Stations Reporting 30
Average snow water equivalent 46.2"
Percent of April 1 Average 209%
Percent of normal for this date 231%

STATEWIDE SUMMARY

Data For: 03-Mar-2023

Statewide, California snowpack is 190% of normal, almost double.
(California Department of Water Resources / FOX Weather)

2022/2023 snow season rivals record snowpack

"This snowpack actually rivals 1982 and 1983, which is the largest snowpack on record. With the next few storms here, throughout this month, we could actually surpass that and that's something we're gonna be looking out for by the time we get to April 1. The southern Sierra actually has almost over two years of snow waiting to melt, with more to come," said de Guzman.

To Bay Area legendary forecaster and professor of hundreds of other forecasters, Jan Null, it all adds up to this.

"For most places, you know, we really have knocked the legs out from under this drought. For most purposes, the state is out of drought certainly as far as rainfall," said Null.

A significant snowpack runoff is not expected for at least another month.

"This snowpack is a cold snowpack right now," said de Guzman.

Only extreme heat and very warm rain can upset what should otherwise be a highly manageable runoff.

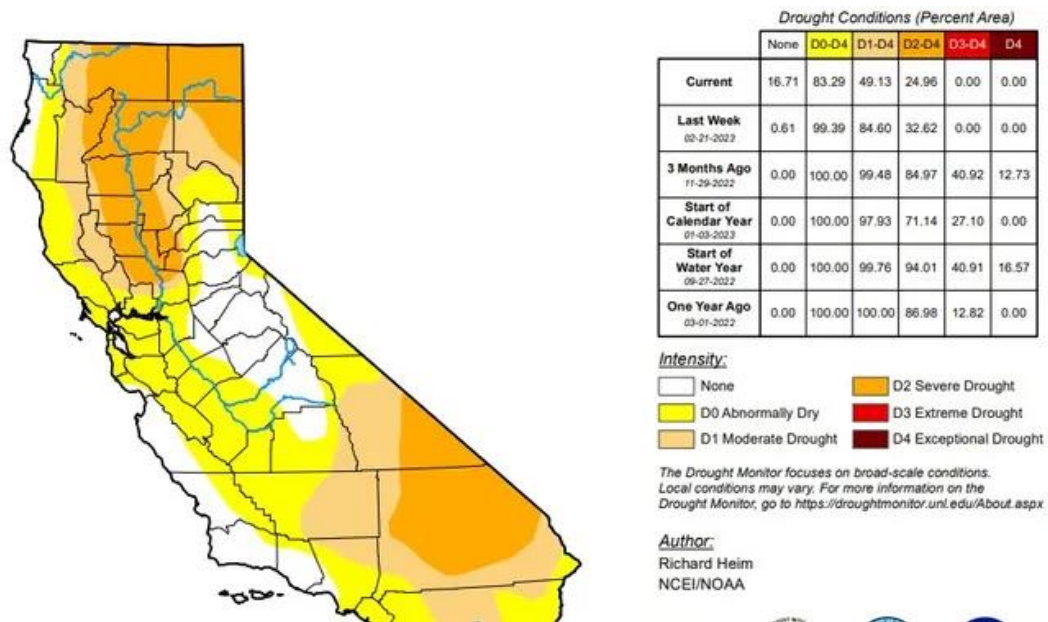


Image 1 of 2: Early March's Drought Monitor shows only 49.13% of the state in drought. (US Drought Monitor)



Image 2 of 2: Compare this Drought Monitor with large areas of Extreme and Exceptional Drought from September 2022 to the most recent which is absent of the reds. (National Drought Mitigation Center)

"I think the biggest consequences will be on the potential for flooding depending on rain patterns and temperature patterns as we go in through this month and certainly in April probably as well," said Null.

Another piece of great news is that much of that Sierra runoff will have to pass through dozens of hydroelectric power generation plants. Unlike natural gas, the fuel and water are free and should cut electricity bills, especially at times of peak power use this summer and fall.

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See How California's Drought Conditions Improved After a Wet February

Storms in January and February wiped drought off the map for parts of California

NBC Universal | March 2, 2023 | Jonathan Lloyd

More than half of California is drought-free after what was anything but a dry February.

After unrelenting storms brought rain and snow last month, only 49 percent of the state remains in the moderate drought category, according to this week's U.S. Drought Monitor report. That figure stood at 99 percent in October at the start of California's water year.

"January was a very wet month for us, and February is going down in the record books," said NBC4 forecaster Belen De Leon. "When we started the water year, we had exceptional, extreme drought conditions all across the state.

"Today, things are looking much better. This is a result of all the rain, all the snow."

Moderate drought is the least severe of four categories in the weekly report. The most severe drought categories were wiped off the map earlier this winter.

About 25 percent of the state remains in severe drought, a significant improvement from the start of the water year when 94 percent of California was in that category.

Drought conditions were eliminated this week along portions of the California coast, including Ventura and Santa Barbara counties, and part of Los Angeles County.

"When we look at the rain surplus, not only are we on pace, we're ahead of pace when it comes to our seasonal average," said De Leon.

The central Sierra Nevada Mountains and foothills also are out of the drought categories for the first time since January 2020.

"The rain has improved California soil moisture and streamflow levels, while the snow has increased mountain snowpack to much above-normal levels," according to the Monitor. "Most California reservoirs have refilled with water levels near or above average, but groundwater levels remain low and may take months to recover."

The U.S. Drought Monitor is a joint project of the National Drought Mitigation Center at the University of Nebraska-Lincoln, the National Oceanic and Atmospheric Administration and the U.S. Department of Agriculture. The Drought Monitor report released Thursday includes information available up to Feb. 28.

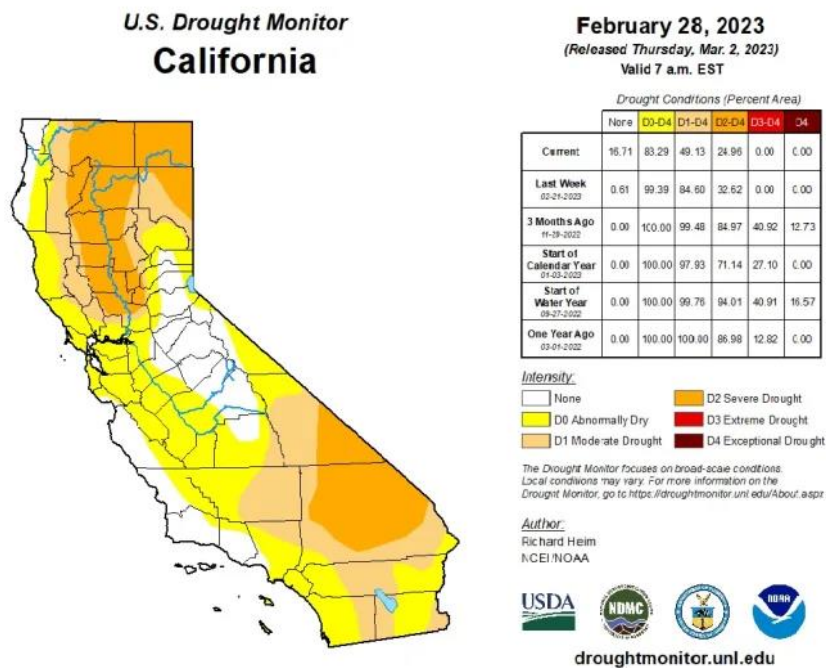
California has spent most of the last 15 years in drought. The current dry spell included one of the driest late winters on record.

The state's normal wet season runs from late fall to the end of winter, but dismal precipitation left about 95 percent of California in severe drought at the start of spring. By September, nearly all of California was in drought.

Much of California's water comes from melting snow in the Sierra Nevada Mountains. In an ideal scenario, storms blanket the mountains with snow during winter, building up the natural reservoir. That snow then melts in late spring and early summer, replenishing the state's water system. Snowpack was far below normal in Spring 2022.

California's statewide snowpack level was more than 200 percent above normal in mid-December after powerful December storms blanketed the Sierra Nevada Mountains with snow. That total has improved after February storms brought several more feet of snow.

The water content of the Sierra snowpack, which provides about a third of California's water, is more than 160% of the historical average on April 1, when it is normally at its peak, according to the state Department of Water Resources.



###

Water experts explain what large snowpack levels mean for the Valley

Record-breaking atmospheric rivers hit the state in January, and while that may cause some to rejoice and believe the drought is over, experts at the California Water Institute caution farmers and other water stakeholders about the impact of the storms.

Fresno State News | March 2, 2023 | Julissa Zavala



“The way the water is coming, it’s like we’re taking huge gulps — like trying to put a pitcher of water through a straw,” said Laura Ramos, associate director for research and education at the California Water Institute. “There’s so much water in the pitcher and the straw is so thin that we’re not able to capture all the water. A lot of that water is running off to other areas and is not always percolating into the ground where we need it.”

Charles Hillyer, associate vice president for the California Water Institute, said surface water and groundwater can be seen as the state’s checking and savings account, respectively. The checking account is where water is withdrawn first, and when that gets too low, we dip into the savings account. How much money goes into that checking account depends largely on how much snow falls in the mountains, he said.

On Feb. 1, the Department of Water Resources conducted the second snow survey of the season at Phillips Station, which recorded 85.5 inches of snow depth and a snow water equivalent of 33.5 inches, which is 193% of average for this location and date. Statewide, the snowpack is 205% of average for that date, according to the survey.

Despite this good news, the Bureau of Reclamation announced its initial 2023 water supply allocations for Central Valley Project water users, and irrigation water service and repayment contractors south of the Delta were allocated just 35% of their contract total.

“When the snowpack is really good, people like to think that they’re going to get their full water allocation based on their water right,” Hillyer said. “When [farmers] plan on receiving a big dose of water and they don’t, that’s pretty painful for them.”

Water leaders agree that if this was a normal year with an abnormally high snowpack, they would be optimistic. California, however, rarely has an “average” or “normal” year and is in a constant state of peaking and dipping, Ramos said, going from extremely dry years to wet years, making it hard for farmers or irrigation districts to plan.

Many factors also affect the snowpack, including climate change, damage from forest fires and inadequate infrastructure.

Sargeant Green, a research scientist with the California Water Institute and Center for Irrigation Technology, said when fires occur in dense forests, they burn the trees that provide shade to the forest floor. That shade allowed snowmelt to gradually percolate into the soil. More exposed areas also allow for the evaporation of the water into the atmosphere from sunlight, he said.

Fires also cause organic materials to burn and turn into a wax-like substance that permeates the soil and prevents water from percolating into the ground, causing the water to run off quickly instead of getting down into the cracks that feed into the streams and storage reservoirs later in the water year, Green said.

California, one of only five Mediterranean climate regions in the world, is characterized by mild wet winters and warm and dry summers. The state’s infrastructure was made for a climate that was getting a lot more snow and longer winters.

Steve Blumenshine, interim executive director of CSU-WATER (Water Advocacy for Education and Research), said the infrastructure worked fine when the snowmelt was predominantly in May and June, because the climate during the summer is hot and dry — perfect growing conditions.

“The old system was great because the natural reservoir was that snowpack on the mountains,” Blumenshine said. “When that melted, we built all these reservoirs in the state and federal water projects to receive that and distribute it.”

Now, however, that snow is melting earlier in February or March due to warmer temperatures, and the crops that need that water during the summer aren’t able to get it, Blumenshine said.

Reservoirs do not just hold water for irrigation and cities, they are there to protect the Valley floor from flooding. Some experts are predicting that a greater proportion of mountain precipitation is going to be water, not snow, so holding water earlier in the year may be a risk.

“Do we want to store some of that water? Yes. Can we? Not always,” Ramos said. “Those reservoirs need to have that capacity and that empty space just in case there’s a huge melt.”

Water stakeholders from different sectors need to come together to figure out solutions, Green said. “We live in a different world now. In the last 20 years, the need for water operations to change has become dramatic. We’ve got to figure out better ways to do some of these things.”

The third snow survey of the season is scheduled to take place at Phillips Station on March 3. As the water year progresses, the Bureau of Reclamation said changes in hydrology, actions that impact operations and opportunities to deliver additional water will influence future allocations.

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Here's how this week's winter storms added to California's booming snowpack

San Francisco Chronicle | February 25, 2023 | Jack Lee and Claire Hao



People stand in the Alpine Base parking area at Palisades Tahoe during the winter storm that added to an already above-average snowpack on Friday, Feb. 24, 2023. John Locher/Associated Press

California's mountains have seen an epic amount of snow this year. A historic series of storms in December and January built up the state's snowpack so much that it kicked off February at nearly twice its usual amount.

Then the weather turned cold and dry — until this week, that is.

The winter storms that brought snow to the Bay Area on Thursday and Friday have added even more to this year's colossal Sierra snowpack.

The UC Berkeley Central Sierra Snow Lab, a research station located on Donner Summit, has recorded 120% of the average snowfall for an entire winter season and 176% of the typical snowfall to date for this time of year, according to a tweet from the lab.

We are now at 120% of our average seasonal #snowfall (432" this year, 360" normally) and 176% of our normal snowfall to this date in the season.

36 feet of snow is deep but we're preparing for more! The next week of predicted storms could bring us to 40 or even 45 feet of snow! pic.twitter.com/wb9yDYybSc

— UC Berkeley Central Sierra Snow Lab (@UCB_CSSL) February 24, 2023

The lab has measured a whopping 432 inches (36 feet) of snow this water year, compared to 360 inches normally, the tweet said. The water year runs from the beginning of October through the end of September annually.

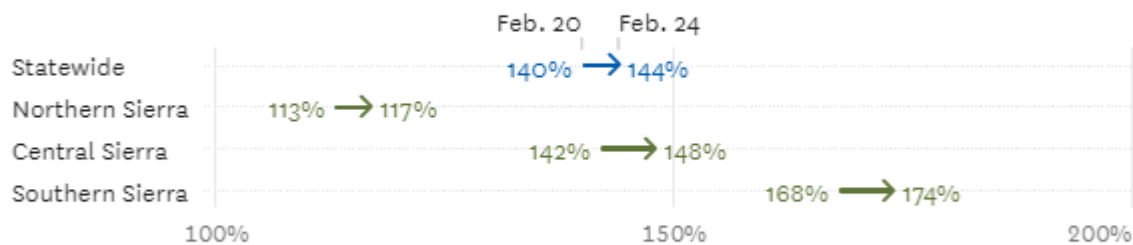
Andrew Schwartz, lead scientist of the Central Sierra Snow Lab, said this week's storms added 4 to 6 feet to the snowpack, which is not necessarily uncommon in the Sierra. The lab is above 7,000 feet in elevation, and it can see several storms a year that bring three feet of snowfall per day.

Next week's predicted storms could build the snowpack to 40 or even 45 feet, tweeted the lab.

Across the state, measurements on Feb. 24 placed the average snow water equivalent — how much water the California-wide snowpack contains — at 37.6 inches, or 144% of the April 1 average. That's up from 140% reported on Monday, Feb. 20, before this week's storms.

How this week's storm affected Sierra snowpack

Snowpack as a percentage of April 1 average



Data as of Feb. 24.

Chart: Jack Lee / The Chronicle • Source: [California Department of Water Resources](#)

Schwartz said that the lab's numbers so far this year are "really good news." The snowpack generally peaks around late March or early April and determines how much water will be available for use in the coming year.

"We're already well above that late March or April 1 measurement, which means that, in terms of snowpack at least, we can look at helping resolve the drought a little bit," Schwartz said.

However, the state still needs to see what the rest of the wet season brings, he added. The lab has recorded 137% of average precipitation — which includes rain and snow — that it usually sees by this time of year, but only 87% of the average total seasonal precipitation, Schwartz said.

"We really need the rest of the winter to stay moist and for the storm window to stay open to bring us even more rain and snow," he added. "Because even though the short-term drought has kind of taken a hit with these most recent storms, we're going to need a lot more precipitation to talk about resolving the long-term drought overall."

###

With all this rain and snow, can California really still be in a drought? Look Deeper

LA Times | February 22, 2023 | Hayley Smith



Houseboats dock down the middle of a large reservoir flanked by arid hills

Lake Oroville, seen at the beginning of February, is one of the state's largest reservoirs and currently at 71% capacity following the January storms. Despite the improved water conditions, all of the state remains under some form of drought. (Brian van der Brug / Los Angeles Times)

Only weeks after a series of atmospheric rivers deluged California, the state is once again bracing for powerful winter weather that could deliver heaps of rain and snow, including fresh powder at elevations as low as 1,500 feet.

But as worsening climate extremes and water supply challenges continue to bedevil the state, officials cautioned residents Tuesday not to assume that the recent moisture signaled an end to the drought. The entire state remains under a drought emergency declaration that Gov. Gavin Newsom issued in 2021, with millions of residents still under strict watering restrictions.

"I want to be clear that these storms — and the likely rain and snow we may get over the next few weeks — did not, nor will they fully, end the drought, at least not yet," said Yana Garcia, secretary of the California Environmental Protection Agency. "We're in better shape than we were two months ago, but we're not out of the woods."

Indeed, the state's wet season typically runs until April, and despite the impending storm, there remains much uncertainty about what the coming months may hold. Most of February was notably dry, with only 0.85 inches of precipitation falling statewide in the wake of January's flooding.

Experts said it will take more than a series of storms to make up for years of deficits. Some said declaring the drought over now — or possibly ever — would be a mistake.

“We’re now in a situation in California where there’s never really enough water anymore to do all of the things that everyone wants, and to declare the drought over, or the emergency over, I think would send the wrong signal,” said Peter Gleick, co-founder and president emeritus of the Pacific Institute. “I think people should still be cautious and careful and efficient, and I think water agencies should be pushing for continued improvements in water use.”

Part of the challenge is that surface conditions — including reservoir levels and snowpack — aren’t the only factors in California’s water supply. Groundwater, or the state’s system of underground aquifers, remains perilously low, particularly in the Central Valley where climate change and overpumping have left it dangerously depleted.

What’s more, Southern California’s other major water source, the Colorado River, didn’t benefit as much from January’s storms and is dipping toward record lows. Federal officials have ordered California and six other states to dramatically cut diversions from the river, which has long served as a water lifeline for the West.

But even surface conditions are changing under the state’s evolving climate, which is trending toward long-term heat and dryness while being punctuated by bouts of extreme precipitation. Snowpack is regularly melting earlier than in years past, and the state’s water managers are increasingly tasked with preparing for drought and flood events at the same time.

“We have been working day in and day out to adjust to a changing reality,” said California Natural Resources Secretary Wade Crowfoot. “We know that extreme weather is getting more extreme as a result of climate change. In October, we finished one of the driest three-year periods in our state’s history, and then just last month, we experienced what is probably the wettest three weeks in our history.”

Gleick said there is often a measurable “rebound effect” after state officials remove drought orders, as former Gov. Jerry Brown did in 2017 following a similar series of storms. Though some Californians may have made permanent changes, such as removing their lawns or upgrading to water-efficient appliances, many behavioral changes are more ephemeral. People may go back to watering their grass, taking long showers or wasting water, Gleick said.

He also noted that there is a difference between a hydrologic drought and a political one, with Newsom’s drought emergency declaration giving the state authority to assist local areas with water supply challenges. While some actions can and should be taken locally, “there’s still things that the state needs to be doing in terms of funding, in terms of setting targets for efficiency improvements, in terms of changing the way that we operate the reservoirs, and in terms of how we allocate water on the State Water Project,” he said.

Declaring the drought over now would be “premature hydrologically and politically,” he added.

It was a message echoed by members of Newsom's administration, including Department of Water Resources director Karla Nemeth. She noted that in just a few dry weeks, statewide snowpack declined from 205% of normal on Feb. 1 — a 40-year high for the date — to 174% of normal for the date on Tuesday.

"That is an extremely steep drop-off, and it's due to the dry weather that resumed in late January and has really followed us through February," Nemeth said. "That really does tell the story for the challenges that we face over the remaining days of February, March and April."

However, the state has also received some criticism for its response to such weather swings this year, including its ability to capture and store stormwater when it falls. During January's storms, millions of gallons of water were channeled out to the ocean, with agencies at state and local levels being called upon to do more to improve their response in the future.

Newsom's sweeping water supply strategy, unveiled in August, includes adding 3 million acre-feet of new storage and expanding groundwater recharge capabilities by at least 500,000 acre-feet, among other goals, Garcia said. An acre-foot is approximately 326,000 gallons.

The governor last week also came under fire from some environmental groups for seeking to waive regulations in the Sacramento-San Joaquin River Delta intended to protect fish and other wildlife. The move would ease some state and federal requirements to allow water managers to hold back more water from the delta for storage in reservoirs, which could bolster supplies but potentially harm imperiled fish, the groups charged.

Such tensions reflect the challenges of balancing the state's water needs amid the driest 23-year period in at least 1,200 years — including the needs of urban and agricultural areas as well as that of the environment.

State Water Resources Control Board Chair Joaquin Esquivel noted that despite recent rains, many communities in California are still relying on bottled or hauled water to get by. About 900,000 people, primarily in the Central Valley, are still living without reliable access to safe drinking water, he said.

"What we're trying to make sure we're emphasizing and supporting are the local management decisions that are ensuring that stormwater capture, water recycling and desal[ination] are becoming important parts of communities' portfolios," he said.

There's no denying the storms made a difference after so many months of dryness. The state's largest reservoirs — Lake Shasta and Lake Oroville — were at 59% and 71% capacity respectively as of Tuesday. That's a significant increase from just two months ago, when they were at 32% and 29% capacity.

While conditions have improved, all of the state remains under some form of drought, according to the U.S. Drought Monitor, with 33% of the state designated as being in severe drought. Officials said a likely return to dryness in the future is all the more reason to save every drop while it's here.

“This wouldn’t be the first time we’ve been teased by heavy precipitation early in the rainy season, only to have our hopes somewhat dashed in the months to come,” Garcia said. “We really face the reality that a return to dry weather could wipe out some of the recovery we’ve had this year, and that’s a challenging space to be in.”

#

What to Know: How California Decides If We're in a Drought

A slew of different measurements go into determining whether the state is in a drought — and how severe that drought is

NBC Universal | February 22, 2023 | Jonathan Bloom

California has spent much of the last decade in severe, multi-year droughts, and most of the state remains in drought status in spite of recent heavy rainfall. Here's how droughts are measured, and what the measurements mean.

Some of the rainiest weeks since the Gold Rush left the state and the Bay Area drenched, but didn't technically end California's drought.

Here's what to know about how the state decides what's a drought and what's not.

The Golden State is, of course, no stranger to droughts: we've been living through them for most of the last decade. They can mean big wildfires, bad growing conditions for farmers, and water restrictions.

Three Kinds of Drought

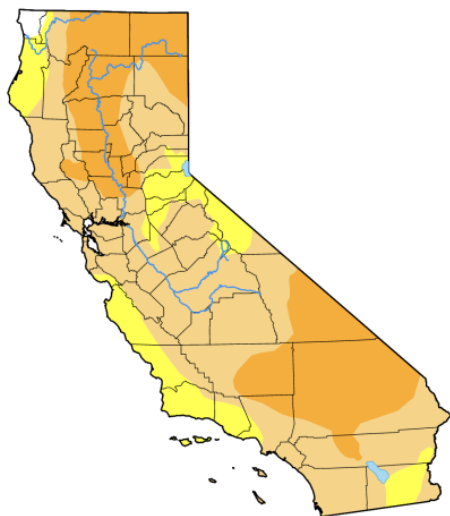
Droughts can be measured in a lot of different ways, but there are three basic kinds of drought that scientists look at.

- A meteorological drought means a lack of rainfall. In this case, those big storms left California doing just fine in that department.
- An agricultural drought generally means there's not enough moisture in the soil, which makes it hard for plants to grow.
- A hydrologic drought means that rivers, streams and groundwater are lower than normal.

The U.S. Drought Monitor

All three of those factors go into something called the U.S. Drought Monitor. It's a map that comes out every week on Thursdays, and you might've seen it in our weather forecasts here at NBC Bay Area.

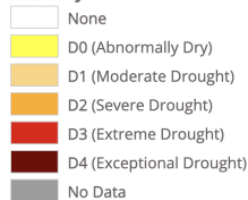
California



Map released: Thurs. February 16, 2023

Data valid: February 14, 2023 at 7 a.m. EST

Intensity



Authors

United States and Puerto Rico Author(s):
Brian Fuchs, National Drought Mitigation Center
Pacific Islands and Virgin Islands Author(s):
Tsegaye Tadesse, National Drought Mitigation Center

Courtesy:
National Drought Mitigation Center
A U.S. Drought Monitor map for February 16, 2023 showed the majority of California in a moderate drought, with some parts of the state remaining in a severe drought.

It breaks up the country into color-coded areas — from yellow, which is just abnormally dry, all the way to a deep red color that signifies an "exceptional" drought — the kind where entire crops die off, and wells run dry.

Right after the heavy rains in January 2023, the U.S. Drought Monitor map showed most of California in a "moderate" drought, and left a few places in a "severe" drought — the kind where fire danger is high, and fire season lasts longer.

The rains did manage to eliminate the areas of "extreme" drought, which is when fire season can last year round.

Reservoirs and Snowpack

The U.S. Drought Monitor is a national index. But here in California, there are other things state regulators look at.

First, there are reservoirs, including the big ones that are part of the State Water Project. Even the biggest rainstorm is not enough to refill the state's largest man-made lakes after a multi-year drought — but that incredibly wet January got close, and brought them to 96 percent of their historical average.

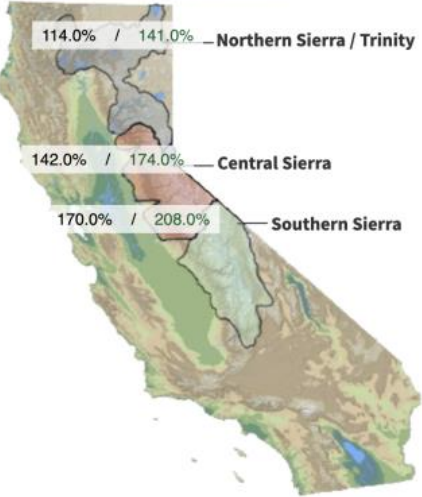
Then there's the Sierra snowpack, which actually makes up 30 percent of the state's water storage. A month of storms at the start of 2023 put that above its historical average, at 138 percent by mid-February.

Snow Water Equivalents (inches)

Provided by the California Cooperative Snow Surveys

Data For: 22-Feb-2023

% Apr 1 Avg. / % Normal for this Date



NORTH	
Data For: 22-Feb-2023	
Number of Stations Reporting	30
Average snow water equivalent	32.9"
Percent of April 1 Average	114%
Percent of normal for this date	141%

CENTRAL	
Data For: 22-Feb-2023	
Number of Stations Reporting	51
Average snow water equivalent	38.3"
Percent of April 1 Average	142%
Percent of normal for this date	174%

SOUTH	
Data For: 22-Feb-2023	
Number of Stations Reporting	29
Average snow water equivalent	38.0"
Percent of April 1 Average	170%
Percent of normal for this date	208%

STATEWIDE SUMMARY	
Data For: 22-Feb-2023	
Number of Stations Reporting	110
Average snow water equivalent	36.7"
Percent of April 1 Average	140%
Percent of normal for this date	173%

Courtesy: California Department of Water Resources

A map of snow water content measured in California showed the state with an above-average amount of water stored in snow as of February 22, 2023.

But the more important snowpack measurement happens in April, at the end of snow season, because snow can start to melt early during a warm winter. Water managers want it to pile up and stay frozen, so it can melt in the summer, and run off into creeks and streams that feed the state's water system.

Wells Running Dry

In just the last decade, the state started tracking another indicator: problems with wells — especially in areas that depend heavily on groundwater, like the Central Valley. Some communities get most or all of their water from huge underground lakes that both homes and farms rely on, and those subterranean bodies of water can take a lot longer to fill back up than lakes on the surface.

In the summer of 2022, there were more household wells that literally ran out of water than any other quarter since state authorities started keeping track. And even after the big storms a few months later, almost two-thirds of the wells the state uses to measure and monitor groundwater were below their normal level.

It all means the wet start to 2023 got California closer to being out of a drought, but not all the way there. Droughts are stubborn, and even those unprecedented storms left the state needing more rain and more cool temperatures to officially get out of drought status.

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Before and after photos show recovery at drought-stricken California reservoir

USA Today | February 21, 2023 | Camille Fine

Recent downpours in critically drought-stricken California have helped to replenish reservoirs – but scientists caution people to not get the wrong impression from images of areas with seemingly abundant amounts of water.

A series of damaging winter storms from December 2022 into January provided some sorely needed resources for farmers, wildlife, and residents – who have faced among the lowest precipitation and lake levels since the 1970s. But it's unlikely to reverse the region's decades-long decline in water reserves that supplement surface sources used for irrigation and other purposes, according to NASA.

A caution sign is posted at the Castaic Lake reservoir in Los Angeles County, with hills scorched by the recent Route Fire in the distance, on October 4, 2022 in Castaic, California. The reservoir, part of the State Water Project, is currently at 35 percent capacity, below the historic average of 43 percent.

“The abundant water is expected to recharge the groundwater in the next few months, as we have seen during similar events in 2011 and 2017,” said Pang-Wei Liu, a scientist at NASA's Goddard Space Flight Center. “However, if the climate pattern is the same as before – dry and hot in summer followed by low precipitation – and the water demands are still high, then we expect the groundwater drawdown will continue.”

Side by side images of one of the two largest reservoirs in the state, Lake Oroville, show the impact of recent winter storms.





Lake Oroville's capacity rose 36% from November and was at 64% capacity as of January 30, or about 111% of the historical average for the time of year, NASA said.

As of this week, levels stood at 115% of the historical average for the date – a notable jump from just 61% in February 2021 and 77% in 2022.

Water crisis in West: Massive reservoir Lake Powell hits historic low water level

'Dead pool' approaches: Western water crisis looms as California complicates critical water deal

The tan fringes around the lakes known as “bathtub rings” – which appear when calcium and other mineral compounds attach to the sandstone during instances of higher water levels – were mostly underwater again by late January.



July 22, 2021



Feb. 14, 2023

Credit: Justin Sullivan

July 22, 2021



Feb. 14, 2023

Credit: Justin Sullivan

April 27, 2021



Credit: Justin Sullivan

Feb. 14 April 27, 2021



Credit: Justin Sullivan

Feb. 14, 2023

July 22, 2021



Credit: Justin Sullivan

Feb. 14 July 22, 2021



Credit: Justin Sullivan

Feb. 14, 2023

“Even the wettest wet seasons are simply never enough to make up for the far greater amount of groundwater that California extracts each year,” said Arizona State University Professor Jay Famiglietti.

#

California water officials raise State Water Project allocation after storms

CNBC | February 22, 2023 | Emma Newburger

KEY POINTS

- California water officials announced that they are increasing supplies for water agencies serving about 27 million people and 750,000 acres of farmland.
- The Department of Water Resources (DWR) said that the modest increase in forecasted State Water Project deliveries this year is due to early gains in the Sierra Nevada snowpack.
- DWR now expects to deliver 35% of requested water supplies, up from 30% forecasted in January.



A caution sign is posted at the Castaic Lake reservoir in Los Angeles County on October 4, 2022 in Castaic, California. The reservoir, part of the State Water Project, is currently at 35 percent capacity, below the historic average of 43 percent. Mario Tama | Getty Images

As California prepared for a powerful winter storm system on Wednesday, state water officials announced that they are increasing supplies for water agencies serving about 27 million people and 750,000 acres of farmland.

The Department of Water Resources (DWR) said in a news release that the modest increase in forecast State Water Project deliveries this year comes because of early gains in the Sierra Nevada snowpack, which translated to an additional 210,000 acre-feet of water. DWR now expects to deliver 35% of requested water supplies, up from 30% forecasted in January.

“We’re hopeful that more storms this week are a sign that the wet weather will return, but there remains a chance that 2023 will be a below average water year in the northern Sierra,” DWR Director Karla Nemeth said in a statement.

“Careful planning and the use of advanced forecasting tools will enable the department to balance the needs of our communities, agriculture, and the environment should dry conditions continue this spring and into next year,” Nemeth added.

The State Water Project collects water from rivers in Northern California and delivers it to 29 public water suppliers. About 70% of that water is used for urban areas and industry in Southern California and the San Francisco Bay Area, while 30% is used for agriculture in the Central Valley.

The modest increase in water allocation comes as California grapples with more than three years of drought and low reservoir levels. Last year, water officials cut the State Water Project allocations to just 5% amid declining reservoir levels and reduced snowpack.

DWR officials warned the new allocation could be adjusted back down if extreme dry conditions warrant.

The Federal Bureau of Reclamation on Wednesday also made an announcement about allocations for users of Central Valley Project water, which are mostly irrigation districts that supply farms. Farms that received zero initial water allocations last year are now set to get 35% of their allocation this year.

“While we are cautiously optimistic, we are also cognizant of the uncertainties that exist and the fluctuating nature of California’s climate with the possibility that dry conditions will return,” Reclamation Regional Director Ernest Conant said in a statement.

#

Reclamation announces initial 2023 water supply allocations for Central Valley Project contractors

Maven | February 22, 2023 | Bureau of Reclamation



Today, the Bureau of Reclamation announced initial 2023 water supply allocations for Central Valley Project water users. Water supply allocations are based on an estimate of water available for delivery to CVP water users and reflect current reservoir storage, precipitation, and snowpack in the Sierra Nevada.

“While we are cautiously optimistic, we are also cognizant of the uncertainties that exist and the fluctuating nature of California’s climate with the possibility that dry conditions will return,” said Reclamation Regional Director Ernest Conant. “We received a much-needed dose of rain and snow in December and January that helped boost the water levels at our CVP reservoirs. The projected runoff from the snowmelt later this year will further benefit the state as we head into the summer months. However, we are all too aware of the precarious nature of recent weather patterns and must proceed prudently as we move through the water year—especially with below average storage in the state’s largest reservoir, Shasta.”

This year’s initial allocations reflect the improved hydrologic conditions caused by the winter storms that left the Sierra Nevada snowpack at well above normal conditions. However, not all river basins were equally improved, highlighting the need that late winter and early spring rain and snow are still needed. Adequate water elevations in Shasta Reservoir are crucial to ensuring deliveries to agricultural contractors and wildlife refuges. It also ensures enough cold water exists for spawning salmon later in the year.

Currently, reservoir storages in Trinity and Shasta reservoirs are below the historic average for this time of year and runoff forecasts indicate that overall storage for these reservoirs may be limited if substantial spring precipitation does not materialize. Other CVP reservoirs, such as Folsom and Millerton, are in better shape with above average water storage levels for this time of year.

Central Valley Project Reservoir Status (as of Feb. 19)

Reservoir	Storage Percent of Capacity	Storage (1,000 acre-feet)	Percent of 15-Year Average
Trinity	32	792	56
Shasta	59	2,675	93
Folsom	54	525	111
New Melones	44	1,059	77
Millerton	51	266	101
San Luis (federal share)	64	618	95

“Three years of record-setting drought in California will take some time to recover from,” said Reclamation Regional Director Conant. “In the short-term, the early winter storms have helped, but in the long-term, we still have much catching up to do, especially in the northern part of our system.”

Based on current hydrology and forecasting, Reclamation is announcing the following initial CVP water supply allocations:

North-of-Delta Contractors

Sacramento River

- Irrigation water service and repayment contractors north-of-Delta are allocated 35% of their contract total.
- Municipal and industrial water service and repayment contractors north-of-Delta are allocated 75% of their historic use or public health and safety needs, whichever, is greater.
- Sacramento River Settlement Contractors’ water supply is based upon settlement of claimed senior water rights. The 2023 water year is currently determined as non-critical, as defined in their Settlement Contracts, which allows for 100% of their contract supply.

American River

- M&I water service and repayment contractors north-of-Delta who are serviced by Folsom Reservoir on the American River are allocated 75% of their historical use.

In-Delta Contractors

- M&I water service and repayment contractors who are serviced directly from the Delta are allocated 75% of their historical use.

South-of-Delta Contractors

- Irrigation water service and repayment contractors south-of-Delta are allocated 35% of their contract total.
- M&I water service and repayment contractors south-of-Delta are allocated 75% of their historical use.
- San Joaquin River Settlement Contractors and San Joaquin Exchange Contractors' water supply is based upon settlement/exchange of claimed senior water rights. The 2023 water year is currently determined as non-critical, as defined in their contracts, which allows for 100% of their contract supply.

Eastside Water Contractors

- Eastside water service contractors (Central San Joaquin Water Conservation District and Stockton East Water District) will receive 100% of their contract total.

Wildlife Refuges

- The 2023 water year is currently determined as non-critical, as defined in their contracts, which allows for 100% of contract supply for wildlife refuges (Level 2), both north- and south-of-Delta.

Friant Division Contractors

- Friant Division contractors' water supply is delivered from Millerton Reservoir on the upper San Joaquin River via the Madera and Friant-Kern canals. The first 800,000 acre-feet of available water supply is considered Class 1; Class 2 is considered the next amount of available water supply up to 1.4 million acre-feet. Given the current hydrologic conditions, the Friant Division water supply allocation is 100% of Class 1 and 20% of Class 2.

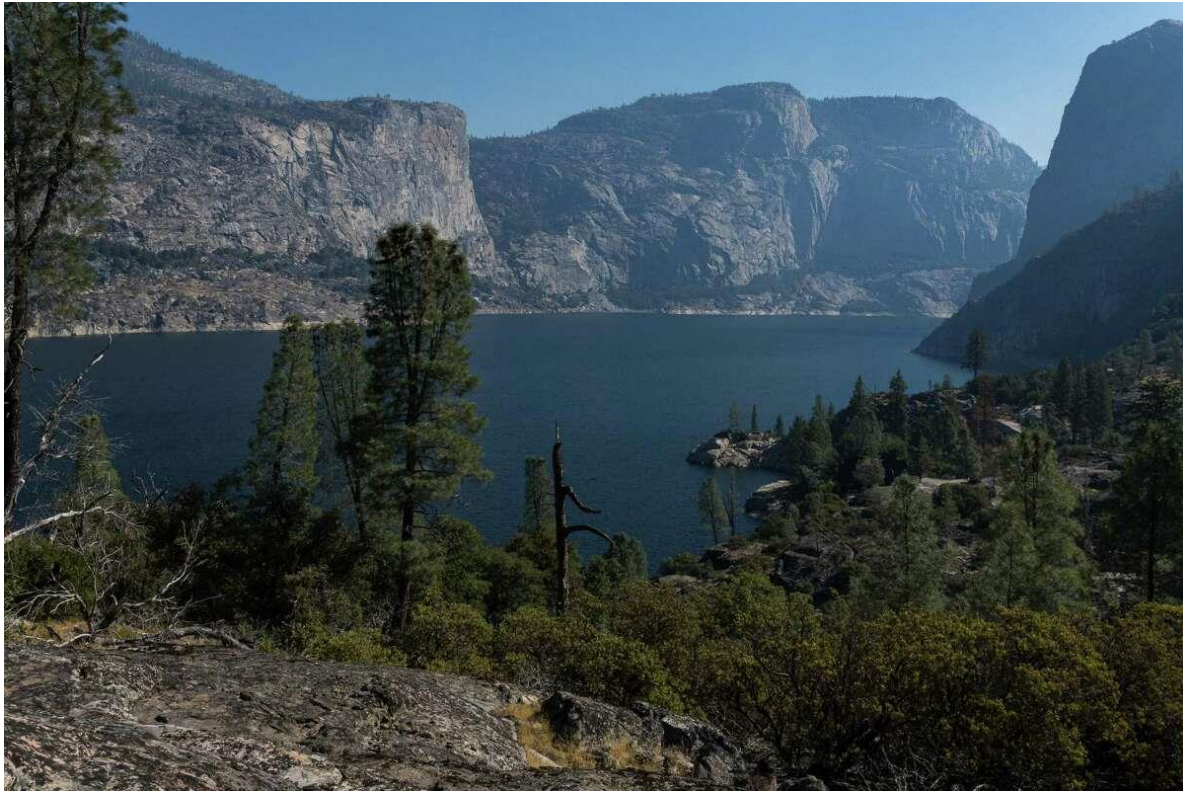
As the water year progresses, changes in hydrology, actions that impact operations, and opportunities to deliver additional water will influence future allocations. Reclamation will continue to monitor hydrology and may adjust basin-specific allocations if conditions warrant an update. Water supply updates are posted on Reclamation California-Great Basin Region's website.

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San Francisco's Hetch Hetchy water system is almost full for the first time in years. Is that a good thing?

San Francisco Chronicle | February 5, 2023 | Kurtis Alexander



Hetch Hetchy Reservoir in Yosemite National Park is seen in 2022. San Francisco's water system, which includes Hetchy Hetchy, is expected to fill this winter for the first time since 2019. Tracy Barbutes, Freelance / Special to The Chronicle

In another sign that California's drought is easing, San Francisco captured more than a year's worth of water in just one month's time.

The tremendous inflow to city reservoirs during the recent storms, mostly in and around Yosemite National Park, has lifted San Francisco's total water storage to near capacity.

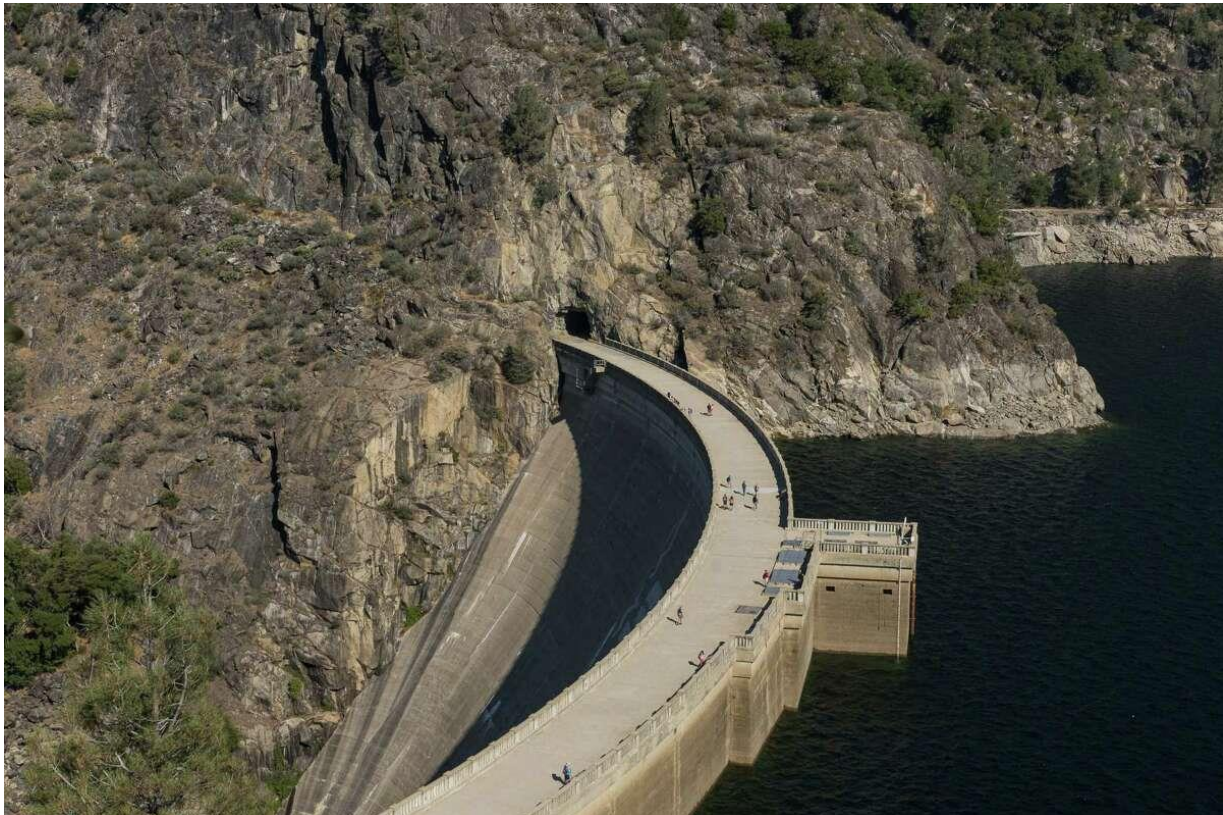
The water system, which includes the landmark Hetch Hetchy Reservoir, is expected to fill this winter, for the first time since 2019, with nearly 1.5 million acre-feet of water. That's enough to supply the city's service area for perhaps seven years.

"It's promising, but too early to let our guard down," said Joseph Sweiss, spokesman for the San Francisco Public Utilities Commission, the city's water purveyor, in an email to The Chronicle. "Remember, much of the state is still in a drought and so the prudence is warranted."

The windfall of water is welcome news for households and businesses in San Francisco, which use less water on average compared to the rest of the state but nonetheless have faced calls to

cut back since 2021 because of water shortages. They've also seen drought surcharges on their water bills. Additionally, the bounty helps the more than two dozen communities in Alameda, San Mateo and Santa Clara counties that get their water from the city.

But the growing water reserves don't please everyone. The surplus has renewed concerns about San Francisco stockpiling water at the expense of rivers — and the fish and wildlife that live there. Some want the city to leave more water in stream channels for threatened salmon while others continue a longshot bid to shut down Hetch Hetchy Reservoir in Yosemite altogether and return the area to its natural state.



Park visitors walk across O'Shaughnessy Dam in Yosemite National Park on Sept. 1. The O'Shaughnessy Dam, which was completed in 1938 and is 430-feet tall, impounds water in Hetch Hetchy Reservoir for communities in the Bay Area. Tracy Barbutes, Freelance / Special to The Chronicle

The SFPUC gets the bulk of its water from a network of reservoirs in the central Sierra Nevada that have long altered flows of the Tuolumne River and its tributaries. The captured water is piped 150 miles to the Bay Area.

A small portion of the city's water comes from local reservoirs.

As of Feb. 1, the system's total water storage was just over 1.3 million acre-feet, or about 92% of capacity. That's up more than 400,000 acre-feet since early December, before the unrelenting series of atmospheric river storms blew through California between Christmas and mid-January.

For perspective, water demand across the SFPUC's service area of 2.7 million people was about 205,000 acre-feet last fiscal year.

Much of the recent inflow was to Hetch Hetchy, which can hold about 360,000 acre-feet of water and was 83% full at the start of the month.

"The north (side of the reservoir) usually has two waterfalls going at the best of times, but you'll see up and down the canyon walls, if you look close, you count there are about 12 waterfalls running now," said Steve Ritchie, the SFPUC's assistant general manager of water enterprise, during a recent drought report to the agency's governing board. "That's just another very strong indication visually that it's a big water year."

According to the SFPUC, the upper reaches of the Tuolumne River have received about 36 inches of rain since the start of the water year in October, almost as much as what the area averages in a year. The snowpack there, which will eventually melt and flow into reservoirs, is already bigger than the average peak snowpack, which typically comes around April 1.

The city's water system also includes a "water bank" at Don Pedro Reservoir along the Tuolumne River, which was full as of Feb. 1. At this facility, which is shared with other water agencies, the city can stash water for credits against future draws on the river. The maximum that the city has put away is 570,000 acre-feet of water.

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This reservoir on the Sacramento River has been planned for decades. What's taking so long?

CatMatters | February 27, 2023 | Alastair Bland



Stone Corral Creek, shown here on Feb. 14, 2023, will be about 200 feet underwater when the Sites Reservoir is built in the western Sacramento Valley. Photo by Julie A. Hotz, for CalMatters

Last century, California built dozens of large dams, creating the elaborate reservoir system that supplies the bulk of the state's drinking and irrigation water. Now state officials and supporters are ready to build the next one.

The Sites Reservoir — planned in a remote corner of the western Sacramento Valley for at least 40 years — has been gaining steam and support since 2014, when voters approved Prop. 1, a water bond that authorized \$2.7 billion for new storage projects.

Still, Sites Reservoir remains almost a decade away: Acquisition of water rights, permitting and environmental review are still in the works. Kickoff of construction, which includes two large dams, had been scheduled for 2024, but likely will be delayed another year. Completion is expected in 2030 or 2031.

Sites Reservoir would store as much as 1.5 million acre-feet of Sacramento River water and could eventually boost water supplies — especially in dry years — for more than 24 million people, mostly in Southern California, and 500,000 acres of Central Valley farmland. The

reservoir is now projected to cost \$4.4 billion, with Prop. 1 covering up to \$875 million and much of the rest coming from federal loans to water suppliers.

For years, state lawmakers, farm representatives and city water suppliers have bemoaned that the reservoir hasn't been built yet, and their criticism has escalated during rainy periods.

In less than two weeks of storms last month, Sites could have captured 120,000 acre-feet of water, enough to serve about 1.3 million Californians for a year, according to water agencies supporting the project.

Rep. John Garamendi, a Democrat from Walnut Grove, is one of many long-time Sites advocates who have grown impatient waiting for the new reservoir.

"California just received 22 trillion gallons of rainwater last month, which could have filled Sites and provided a greater supply of water for the dry months," Garamendi told CalMatters.

Seven water projects are slated to receive \$2.7 billion in Prop. 1 bonds

Chino Basin	Harvest	Kern Fan	Los Vaqueros	Pacheco	Sites	Willow Springs
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Sites Project



Maximum Cash from Bond:	\$875 M
Total Project Cost:	\$3.9 B
Planned Construction Begins:	Late 2024
Planned Operation Begins:	Early 2030
Applicant:	Sites Project Authority
Who Get's the Water:	State Water Project
Claimed Benefits:	Ecosystem Improvements, Water Quality Improvements, Flood Control Benefit, Emergency Response, Recreational Purposes

A large new reservoir would store 1.5 million acre-feet, pulling water from the Sacramento River, and becoming the seventh-largest state-run reservoir.

Gov. Gavin Newsom has rallied for the project, and his 2022 water strategy outlined a plan to create as much as 4 million acre-feet of new water storage space.

The Metropolitan Water District of Southern California, one of many potential investors, might get as much as 20% of the reservoir's water. The Coachella Valley Water District, Santa Clarita Valley Water District and Bay Area residents also could be receiving Sites' water.

Once built, the reservoir will almost certainly provide water storage benefits for people. But whether it will benefit the environment or not is being debated.

Environmental groups oppose the reservoir, fearing it will draw too much water from the Sacramento River and harm imperiled populations of salmon and other fish. An environmental review, which already has gone through multiple rounds of revisions and public comment periods, is still underway and could wrap up this summer.

The reservoir's slow pace of progress doesn't surprise leaders and water supply experts.

"For any large gray infrastructure project, permitting and planning are stages that take time," said Nina Hawk, chief of Bay-Delta Resources for the Metropolitan Water District, which has chipped in about \$30 million for Sites planning.

Jerry Brown (not the former governor of the same name) of the Sites Project Authority, which represents local water districts pursuing the project, said it takes many years to develop and plan projects of this scale.

"My personal rule of thumb is that for every year of construction you spend about three years in the planning-permitting-engineering stage," he said. Since Sites' construction takes six years, the process would be expected to take 18 years.

Who gets the water? And how much?

Proponents say the Sites Reservoir is a necessary step to bolster California's water supply, which is increasingly strained by drought as well as intense wet weather and flooding. Moreover, pressure is on Southern California to sharply cut its use of water from the Colorado River, perhaps increasing the importance of Delta water to Southern California.

Sites would make a small splash in California's water supply: Major reservoirs now hold 50 million acre-feet and Sites would add only about 1.5 million more. The Delta's state and federal systems export an average of 4 to 5 million acre-feet a year. (An acre foot is about 326,000 gallons.)

"It's an increase of a few percent, but it's real water to someone," said Jay Lund, a UC Davis professor of civil and environmental engineering.

The Metropolitan Water District — which delivers 1.6 million acre-feet of imported water a year to 19 million people — would receive about 50,000 more from Sites., adding just 3% to its supply.

Another water district, the Zone 7 Water Agency that serves 270,000 people in the East Bay, would receive about 10,000 acre-feet annually from Sites, increasing its supply about 20%. Valerie Pryor, its general manager, said frequent droughts and residential demand have squeezed supplies, making Sites an appealing option.

Most of the Zone 7 agency's water comes from the State Water Project, which is increasingly strained by drought and so far this year will deliver only 35% of requested water.

"With declining reliability and some population growth, we do need some additional water supply," Pryor said. She added that stormwater capture and continued conservation efforts will only go so far in making ends meet.

Climate change models suggest California will see longer, drier droughts and shorter but more intense wet periods – a pattern that has emerged prominently in the past several years. This is the sort of pendular weather pattern that Sites is being designed to take advantage of, by grabbing water when it's abundant.

A massive project: How the reservoir will be built

Named for the historic quarry town of Sites, which will be submerged if the project is built, the reservoir would occupy remote hills and creek valleys west of the Sacramento River. Two large dams would contain the water, along with seven structures called saddle dams, which will close in the northern side of the basin like the rim of a large bowl.

Sites Dam will be nearly 300 feet high and more than 700 feet in length; Golden Gate Dam will be about the same height and three times as long. The saddle dams, though not as tall, will be huge features, as well: One is sketched out in planning documents at 3,422 feet in length. Also included is a pair of tunnels 23 feet wide and 3,000 feet long. Building all of these features will account for much of the reservoir's \$4 billion price tag.

Mixing concrete for the dams could require as much as a million gallons of water per day for four years.

Other big tasks include buying land from local owners, ripping out a country road, demolishing structures, removing septic systems, clearing trees, scouring out mountains of topsoil and distributing it to local farms, and relocating two private cemeteries.

About 15 families live in and near the town of Sites, so building the reservoir will require their relocation. Brown, the project authority's executive director, said acquiring the private properties will be included in the project cost.



Homes and other structures in the small Sacramento Valley town of Sites will be removed when the Sites Reservoir is built. Photo by Julie A. Hotz for CalMatters

About 160 miles of existing canals will be used to transfer water into and out of the reservoir, with plans to build just 20 miles of new conveyance, according to Brown. Energy to pump water into the reservoir — a lift of 300 feet — will come from hydroelectricity generated by the dam's outflow, plus a planned solar array.

Brown said the availability of preexisting canals makes the project viable.

"If we didn't have all of that, this project would not be affordable," he said.

Sites would be different from most of California's other large reservoirs. Shasta, Oroville, Hetch Hetchy and many others were built by damming large rivers. But Sites would be what's called an off-channel reservoir, built away from the river. During storms it will fill with water, which will be delivered via canals and pipelines.

What are the environmental impacts?

Off-channel reservoirs can cause less environmental harm because they don't block major fish migration routes. Still, environmentalists have questioned the reservoir's feasibility and operation: Will there be enough water to fill it? And what impacts will doing so have on fish and other wildlife in the Sacramento River?

John McManus, president of the Golden State Salmon Association, noted that few, if any, of California's dams have been beneficial for Chinook salmon. Today, several native fish species are close to extinction, and the commercially valuable fall-run Chinook salmon may be in danger of dropping below fishable numbers, which could lead to a shortened fishing season this summer, or a complete closure.

McManus thinks operation of Sites Reservoir will worsen the Chinook's plight. "We don't need more reservoirs and dams that will divert more water from the rivers," he said.

Biologist Carson Jeffres is on the fence about the project. Jeffres, a senior researcher at the UC Davis Center for Watershed Sciences, said the impact will depend on how and when water is diverted from the Sacramento River to fill it. He worries that filling the reservoir could drain the floodplains along the river used by fish and wildlife.

"I see so much potential and so much peril at the same time," Jeffres said. "The details of the operation will determine how this plays out."

The Sites planning process has involved multiple rounds of environmental impact reports and a few major changes to the design plan. A 2017 environmental review was deemed incomplete, leading to a revised draft in 2021. In May, the Sites authority is releasing its final report addressing the potential environmental impacts.

There was a big hiccup last year, too, when the State Water Resources Control Board ruled that the project's application for water rights did not adequately analyze water availability. The water board is currently mulling over a possible, controversial update to its plan, which would require that 55% of the river's unimpaired flow reach San Francisco Bay for environmental benefits. The board determined that the Sites analysis failed to "assess or consider" these changes.

The Sites Project Authority resubmitted a more thorough analysis in January and is now waiting for the board to issue a water right that will allow the reservoir to divert water.

Water board officials declined an interview request. But in a brief written statement they said before a water right is granted, "the board must ensure that instream flows necessary for the protection of water quality, fish and wildlife in the Delta can be met sustainably."

"At this point we are at the finish line with what we intend to proceed with," Brown said. "We are full-steam ahead."

Among changes to lessen the environmental impact, the reservoir's capacity has been downsized from 1.8 million acre-feet to 1.5 million.

Doug Obegi, a water attorney with the Natural Resources Defense Council, said there's simply not enough water left in the Sacramento River most years to operate Sites without causing more harm to critically endangered fish.

“A project that is biologically sustainable is not cost-effective, and a cost-effective project leads to extinction, and that is the rub,” Obegi said.

Costly water

The reservoir must provide public benefits in order to receive Prop 1 funding. This money is allocated under the assumption that operating the reservoir will provide recreation opportunities, ecosystem and water quality improvements and enhanced flood control for downstream communities.

Paul Cambra, a public information officer with the California Water Commission, said an assessment of these public benefits will ultimately determine whether all, or just a portion, of the Prop 1 funding will support the reservoir’s construction.

A 2022 federal loan of \$2.2 billion and a \$449 million loan from the U.S. Department of Agriculture to the Sites Project Authority, plus a financial pledge from the U.S. Bureau of Reclamation, will cover much of the rest of the cost.

Once built, the reservoir’s water will cost about \$750 per acre-foot, according to Brown.

“That’s at the reservoir,” he said. The farther it travels, the more the water costs for the recipient, and for Metropolitan, Hawk said, the final cost per acre-foot will be roughly \$1,000 to \$1,300 — considerably more than the average State Water Project’s cost of \$667 per acre-foot.

But Kightlinger, who helped conduct detailed cost-benefit analyses of the project when he worked for Metropolitan, said it’s a lot cheaper than desalinating water.

The Sites reservoir “saves us billions and billions” that would be spent on desalination, Kightlinger said.

Pryor, at the Zone 7 Water Agency, said she understands the need for a cautiously paced planning stage “for a mega-project” like Sites. However, with every drought and deluge that comes, the reservoir’s absence is sorely felt.

“The last three dry years, we were thinking, ‘Wouldn’t it be great if Sites was here?’” she said. “And with the January storms we had, we were thinking, ‘Wouldn’t it be great if Sites was here?’”

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6 Ways California is Capturing & Storing Water from Storms

Published: Feb 24, 2023

- Governor Newsom issued an Executive Order to help accelerate groundwater recharge, stormwater capture, and conservation efforts;
- California is leveraging a historic \$8.6 billion investment and prioritizing groundwater recharge, stormwater capture, reservoir storage, infrastructure improvements, and more;
- **FACT SHEET: How California is Harnessing Winter Storms to Boost Water Supplies**

SACRAMENTO – California is continuing to leverage recent actions and a historic \$8.6 billion investment to ensure that water from storms is captured and conserved to help preserve supplies for communities, wildlife and the environment, and water users if dry conditions return – actions aligned with California’s Water Supply Strategy:

1. **EXECUTIVE ORDER TO CAPTURE & CONSERVE MORE WATER:** Last week, Governor Newsom signed an Executive Order to help accelerate state efforts to capture storm runoff in wet years by facilitating groundwater recharge projects and other conservation measures.
2. **FAST-TRACKING GROUNDWATER RECHARGE:** The state is expanding groundwater recharge by at least 500,000 acre-feet in potential capacity – streamlining permits and \$1 billion for groundwater recharge projects for 88,000 more acre-feet per year.
3. **MAXIMIZING STORMWATER CAPTURE:** \$176 million for 67 stormwater projects and streamlining permitting to take advantage of major storm events.
4. **EXPANDING STORAGE ABOVE & BELOW GROUND:** California is supporting seven locally driven water storage projects that would expand the state’s capacity by 2.77 million acre-feet – about three times as much water as Folsom Lake can hold. And, California is working to expand San Luis Reservoir by 135,000 acre-feet to store more storm runoff.
5. **ADVANCING CLEAR, AMBITIOUS TARGETS:** 142 actions to improve water resilience and bolster water supplies, and a roadmap for expanding urban stormwater capture capacity by 250,000 acre-feet and adding 4 million acre-feet of water storage capacity.
6. **MODERNIZING WATER INFRASTRUCTURE:** California is working to modernize aging water conveyance systems across the state to safeguard long-term water reliability and help carry winter storm runoff into storage.

Leveraging a historic \$8.6 billion committed by Governor Newsom and the Legislature to build water resilience, the state is taking aggressive action to prepare for the impacts of weather whiplash on the state’s water supplies. Governor Newsom is proposing an additional \$202 million for flood protection and \$125 million for drought related actions.

The state will continue to optimize water storage to support environmental needs in the summer and allow for carryover storage for next year if the spring becomes extremely dry. Additionally, the forecasted allocation could be adjusted back down if extreme dry conditions warrant. In addition to optimizing water storage, California continues to accelerate investments in habitat restoration, including \$52 million in grants announced last week to help restore and protect fish and wildlife habitat throughout California.

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EPA announces 100th WIFIA loan to Santa Clara County

EPA provided the 99th and 100th WIFIA loans, totaling \$115 million, to support flood resilience and a seismic retrofit in Santa Clara County.

WaterWorld | February 24, 2023 |



Photo 174214264 © Andreistanescu | Dreamstime.com

The U.S. Environmental Protection Agency (EPA) has announced two Water Infrastructure Finance and Innovation Act (WIFIA) loans totaling \$115 million to the Santa Clara Valley Water District in California. The announcement marks the 99th and 100th loans for EPA's WIFIA program, which has now invested \$17 billion in the nation's water infrastructure.

"From our first loan to Seattle in 2018 to today's announcement of our 100th loan to Santa Clara, EPA's WIFIA program has benefited over 50 million people across the country and created 123,000 jobs," said EPA's Assistant Administrator for Water Radhika Fox. "Ensuring access to clean, safe water is essential. Thanks to the Biden-Harris Administration's historic \$50 billion investment in America through the Bipartisan Infrastructure Law and the availability of other financing options like WIFIA, EPA's efforts to address critical upgrades to water systems in communities is unprecedented."

The two latest WIFIA loans will help provide flood resilience and improve the seismic resilience of a reservoir.

Of the two WIFIA loans, one provides \$41 million to support the Safe, Clean, and Natural Flood Protection Program, and the other provides \$74 million to support the planning and design costs of the Anderson Dam Seismic Retrofit Project.

“We know making smart investments in water infrastructure and technology today remains the most cost-efficient way to ensure Santa Clara County has enough safe, clean water now and into the future,” said John L. Varela, Valley Water Board Chair. “Thanks to WIFIA, we can do this in a cost-effective manner to benefit our rate and taxpayers.”

The Safe, Clean, and Natural Flood Protection Program \$41 million investment will help upgrade and add channel restoration projects in Sunnyvale, San Jose, and surrounding areas in California to manage stormwater that impacts residents, schools, and businesses. Additionally, Santa Clara Valley Water District will improve water quality by implementing erosion control measures that will protect wildlife habitats and enhance recreational opportunities adjacent to waterways.

The Anderson Dam Seismic Retrofit Project will modernize Santa Clara Valley Water District’s largest reservoir to restore lost capacity, address seismic deficiencies, and protect public safety. Santa Clara Valley Water District’s initial \$74 million WIFIA loan will support the planning and design costs of the project facilitating these critical first steps in advancing a major infrastructure improvement project. Santa Clara Valley Water District will use financing from a future WIFIA loan to construct the projects.

This is the first loan under another master agreement that will commit an additional \$580 million in WIFIA assistance to accelerate implementation of Santa Clara Valley Water District’s nearly \$1.2 billion Anderson Dam Seismic Retrofit Project.

EPA estimates the Santa Clara Valley Water District will save approximately \$47 million by financing these two loans with the WIFIA program. Furthermore, the District anticipates further savings – totaling \$256 million – across both projects’ master agreements. Construction and operation are estimated to create 742 jobs.

The 100th WIFIA Loan

Established by the Water Infrastructure Finance and Innovation Act of 2014, the WIFIA program is a federal loan and guarantee program administered by EPA. The WIFIA program’s aim is to accelerate investment in the nation’s water infrastructure by providing long-term, low-cost supplemental credit assistance for regionally and nationally significant projects.

Since the WIFIA program’s inception six years ago, borrowers nationwide have closed 100 loans totaling \$17 billion to help finance \$36 billion in their critical water infrastructure projects. Borrowers have saved over \$5 billion and created 123,000 jobs.

EPA says that these projects will benefit over 50 million people, resulting in 1.2 million people receiving safer drinking water and 1,100 million gallons per day of wastewater receiving more treatment before it is discharged to waterways.

Anderson Dam retrofit project receives big federal loan; troubled Pacheco Dam project remains in limbo

Biden administration EPA set to announce \$727 million in low-interest loans for Santa Clara County water plans

East Bay Times | February 22, 2023 | Paul Rogers



The Santa Clara Valley Water District has proposed building a 320-foot tall dam on Pacheco Creek in Southern Santa Clara County near Highway 152 and Henry Coe State Park, a location shown here in August, 2019. But the project's chances of success have suffered a major setback as geological studies of the area have shown that there is unstable rock, which would increase the cost of the new dam and reservoir from \$1.3 billion to \$2.5 billion. (Photo: Santa Clara Valley Water District)

Two huge dam projects are being planned in Santa Clara County at a price tag in the billions. The Biden administration has decided to help fund one of them but — at least for now — not the other.

At a news conference scheduled for Thursday, the U.S. Environmental Protection Agency is set to announce it has approved \$727 million in low-interest loans to the Santa Clara Valley Water District to help fund the rebuilding of Anderson Dam near Morgan Hill. The largest reservoir in Santa Clara County, Anderson has been drained for earthquake repairs since 2020, exacerbating Silicon Valley's water shortages. Federal dam safety officials were concerned that its 240-foot earthen dam, built in 1950, could fail in an earthquake.

But the water district also asked the EPA for twice as much in other low-interest loans — \$1.45 billion — to help fund construction of a huge new dam near Pacheco Pass and Henry W. Coe State Park.

That \$2.5 billion project has been mired in cost overruns, a lawsuit from environmentalists and a growing disagreement among the district's board members over whether it should even be built or killed. It did not receive a loan from the EPA.

The news is a boost for the Anderson project, whose price tag increased last month from \$1.2 billion to \$1.4 billion. Construction crews currently are building a new outlet tunnel that they

expect to finish in late 2024. They then plan to tear down most of the existing dam and rebuild it, with a completion date of 2032.

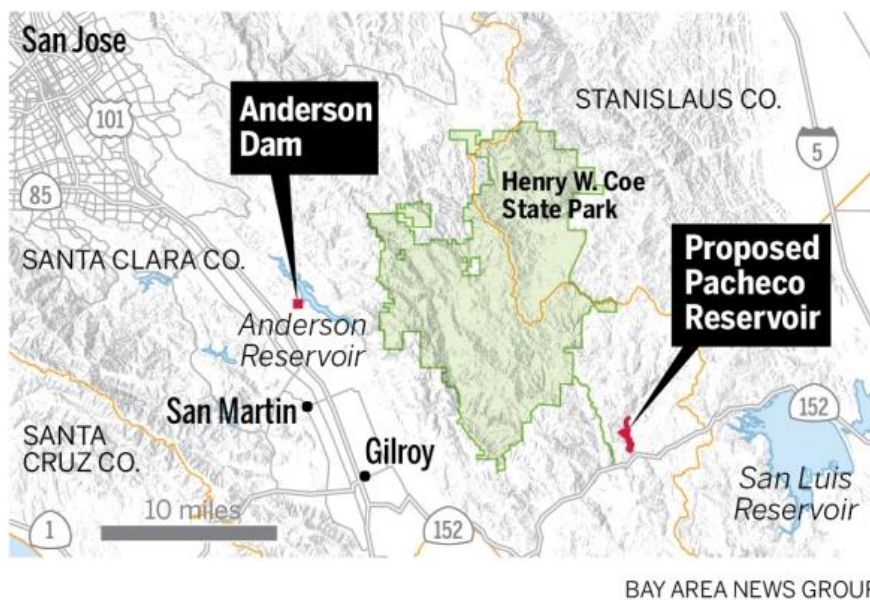
Rick Callender, CEO of the Santa Clara Valley Water District, a government agency that provides water and flood protection to 2 million people in Santa Clara County, said the EPA's Anderson loan, at a 3.7% interest rate, will save the district \$256 million compared to funding it with municipal bonds

"It's a really big deal," he said. "It's the best way to use public dollars to finance the project and pass along the cost savings to the public. We're very excited."

But for the Pacheco Pass project, which would be the largest new dam built in the Bay Area in 25 years, the EPA's move is the latest in a long line of setbacks.

Callender said he has met with EPA officials, and they have not denied funding for Pacheco outright. Rather, he said, they have delayed a decision until after March 16 when the district's board is scheduled to vote on whether to move forward with the project by authorizing its staff to take it from 30% design completion to 60%.

"They pulled apart the loan," Callender said. "They left in Anderson and authorized that. The Pacheco portion is on hold pending future discussions and direction from our board. They wanted to see what happens on March 16."



Map showing the locations of Anderson Dam and the Proposed Pacheco reservoir, both located in Santa Clara County.

Critics contend the dam is too expensive and would harm the rustic environment adjacent to Coe park. The EPA's hesitancy is telling, they say.

"It's significant that there won't be an announcement about Pacheco," said Osha Meserve, a Sacramento attorney representing a group called the Stop the Pacheco Dam Coalition, which has partnered with the Sierra Club and Amah Mutsun tribal band. "It indicates uncertainty about whether the project will go forward. I hope the EPA is taking a closer look."

EPA officials in San Francisco declined to answer specific questions Wednesday about the status of the Pacheco loan.

The district's plan calls for building a 320-foot-high earthen dam on the North Fork of Pacheco Creek in the rugged canyons about 2 miles north of Highway 152 in Southern Santa Clara County.

Construction would start in 2025 and finish in 2032. The new reservoir would hold 141,000 acre feet of water, replacing a small reservoir there that was built in 1939.

With a 35-mile-long shoreline, it would be the largest new reservoir built in the Bay Area since 1998 when the Contra Costa Water District constructed Los Vaqueros Reservoir in eastern Contra Costa County. It also would rank as the fourth largest reservoir in the Bay Area, behind Lake Berryessa in Napa County, Lake Sonoma in Sonoma County and Los Vaqueros.

The district hopes to take water it now stores nearby in the massive San Luis Reservoir and pipe it to a new Pacheco reservoir, filling it during wet years.

The project received a major boost in 2018 when former Gov. Jerry Brown's administration awarded it \$485 million from Proposition 1, a \$7.5 billion water bond passed by voters in 2014.

But it has run into big problems with cost overruns. In 2017, the district estimated the project would cost about \$800 million. The following year, the price jumped to \$969 million, then \$1.3 billion by 2020. In January 2021, the district announced the cost had risen to \$2.5 billion after geological studies found rock in the area was unstable — a finding geologists had noted 20 years earlier when the water district considered, and then dropped, the idea.

At a board meeting Jan. 10, district officials said the price tag now is \$2.78 billion, a jump they said was due to inflation. The district has had no luck so far in securing partnerships with other Bay Area water districts to help pay for the project and share its water.

Former San Jose Mayor Sam Liccardo opposed the plan, saying that the water was too expensive, would cause spikes in water bills for San Jose-area residents and that the money should be spent on cheaper projects, such as water recycling, storm water capture, conservation and helping the Contra Costa Water District enlarge Los Vaqueros Reservoir.

His successor, Matt Mahan, also is skeptical.

"I have concerns about whether several billion dollars for a project like Pacheco, which doesn't meaningfully increase our water supply, is a good use of scarce resources at a time when we have so many other needs," said Mahan, who will appear at Thursday's press conference.

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California water board waives Delta rules that protect salmon

Angering environmentalists, the water board decided that cities and farmers would get more Delta water while restricting flows for endangered salmon and other fish. The move came after Gov. Gavin Newsom suspended key environmental laws.

Press Democrat | February 22, 2023 | Alastair Bland



Low water levels at Shasta Lake on April 25, 2022. The reservoir as of Feb. 21, 2023 was at more than 86% of historic average levels. Photo by Miguel Gutierrez Jr., CalMatters

California's water board decided Tuesday to temporarily allow more storage in Central Valley reservoirs, waiving state rules that require water to be released to protect salmon and other endangered fish.

The waiver means more water can be sent to the cities and growers that receive supplies from the San Joaquin-Sacramento Delta through the State Water Project and the federal Central Valley Project. The state aqueduct delivers water to 27 million people, mostly in Southern California, and 750,000 acres of farmland, while the Central Valley Project mostly serves farms.

The flow rules will remain suspended until March 31.

Environmentalists reacted today with frustration and concern that the move will jeopardize chinook salmon and other native fish in the Delta that are already struggling to survive.

“The flow standard they relaxed is probably the most important regulation we have,” said Gary Bobker, program director at The Bay Institute. He said the rule is aimed at simulating natural runoff in rivers, which is critical for native fish to reproduce and thrive.

The order from the State Water Resources Control Board, signed by Executive Director Eileen Sobeck, comes eight days after Gov. Gavin Newsom suspended two state environmental laws and urged the board to act. Water suppliers and growers had criticized the state for “wasting” water during the January storms by letting it flow through rivers out to sea instead of capturing it in reservoirs.

On the day that Newsom issued his order, the state Department of Water Resources and the U.S. Bureau of Reclamation — which oversee reservoirs and water exports in the Delta — petitioned the board to lift the flow rules.

San Francisco Baykeeper Science Director Jon Rosenfield said this is the third year in a row, and the sixth time in 10 years, that the state has waived its rules that set basic flow standards in the Delta. The previous waivers were issued because of severe drought conditions, while the new waiver was triggered by the opposite: high-volume storm conditions.

“The governor is taking water from winter-run Chinook salmon, which just experienced their worst incubation season ever,” Rosenfield said. “The few that remain could be given a better chance of surviving to the ocean. Instead, they’re going to get worse conditions.”

Water that flows through the Delta and into San Francisco Bay helps young salmon complete their seaward migrations through the estuary, and it improves the estuary’s salinity conditions to the benefit of many species.

If the state’s flow rules had remained in effect, water would have to flow through the Delta at a rate of 29,200 cubic feet per second. But as of Feb. 21, outflow was less than half that, 14,300, Rosenfield said.

Sobeck acknowledged in her order that fish benefit from the flow rules and they “are specifically intended to provide for some population growth of native estuarine species.” But after weighing the cost of harming fish with the benefit of providing water for farms and cities, she made the choice “to maintain and expand water supplies given prolonged drought and uncertain climatic conditions.”

Sobeck wrote that the waiver is permissible only if it’s made in the public interest and “will not result in unreasonable effects to fish and wildlife.”

Winter-run and spring-run Chinook salmon, tiny Delta smelt and several other Delta fish species are listed as threatened or endangered by the state and federal Endangered Species Acts, which prohibit harm to protected species.

Karla Nemeth, director of the California Department of Water Resources, and Ernest Conant, regional director of the U.S. Bureau of Reclamation, said that lifting the flow requirements was unlikely to harm Delta fish.

“Our modeling shows that January’s wet hydrology, along with operational actions..., created conditions that will be protective of species throughout February and March,” they wrote in a letter to the water board.

To allow the water board to waive the flow rules, Newsom’s order suspended two state laws — Water Code Section 13247, which requires state agencies to comply with all water-quality rules, and Public Resources Code, Division 13, which ensures environmental quality, and its regulations.

Environmentalists lambasted Newsom last week, saying that the governor was “putting his thumbs on the scale in favor of extinction in the Delta” and “eviscerating environmental laws” with the stroke of his pen.

But water suppliers applauded the decision today, saying the water is needed to help provide enough water to cities and farms. Currently they are only receiving 30% of requested deliveries from the state aqueduct.

“This grants water users a little cushion,” said Tim Quinn, an affiliate with Stanford’s Water in the West program and a former executive director of the Association of California Water Agencies. “It leaves a little more water in storage than we would have had.”

At the Zone 7 Water Agency, which serves 270,000 people in the East Bay, General Manager Valerie Pryor said she trusts the assessment that increasing Delta exports will not harm fish species.

“We support decisions that are made based on data, not on a calendar or a set of rigid rules that were set up earlier and aren’t looking at real-time data,” she said.

However, fed by the January storms, the state’s main reservoirs, Oroville and Shasta, which had been parched by drought, are at 116.5% and 86.6% of historic average levels.

Although the state received heavy criticism last month for not capturing more water, Bobker said California “did a pretty good job.” His organization estimated that almost half the rain that fell in the Sacramento and San Joaquin watersheds in December and January was captured in reservoirs.

The storms also heavily padded the Sierra Nevada snowpack, which is now at about 200% of average and will melt and drain into reservoirs later this spring.

“But they wanted more, so they suspended the rules,” Bobker said. “It’s not even a drought. If we can’t provide good conditions for fish in a year like this, then we are totally bankrupt as resource managers.”

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Newsom suspends environmental laws to store more Delta water

CalMatters | February 14, 2023 | Alastair Bland



The Bidwell Bar Bridge at Lake Oroville on Jan. 12, 2023. Photo by Andrew Innerarity, California Department of Water Resources

Facing an onslaught of criticism that water was “wasted” during January storms, Gov. Gavin Newsom on Monday suspended environmental laws to give the go-ahead to state officials to hold more water in reservoirs.

The governor’s executive order authorized the State Water Resources Control Board to “consider modifying” state requirements that dictate how much water in the Sacramento-San Joaquin Delta is allowed to flow into San Francisco Bay.

In January, after floodwaters surged into the bay, farm groups, Central Valley legislators and urban water providers complained that people and farms were being short-changed to protect fish. They urged state officials to store more water in reservoirs, which would increase the supply that can be delivered this summer to farm fields in the Central Valley and millions of Southern Californians.

Environmental activists say Newsom’s order is another sign that California is shifting priorities in how it manages water supply for humans and ecosystems.

They said the order will likely harm Chinook salmon and Delta smelt. Large numbers of newborn Chinook salmon have perished in recent drought years — the result of low flows in the Sacramento River and its tributaries.

Doug Obegi, a water law attorney with the Natural Resources Defense Council, called Newsom's order the latest action in "a breakdown of law and order in the Delta." In every critically dry year since 2012, Obegi said, the state's flow rules and water export restrictions have been waived.

"Now, it seems, we're going to start waiving them in average years," Obegi said, adding that it's the first time that the state has waived Delta outflow standards in a year that isn't designated critically dry.

"The executive order seems to signal the governor's intention to put his thumbs on the scale in favor of extinction in the Delta."

The state water board's Delta flow rules are designed to help enforce the federal and state Endangered Species Acts, which protect Chinook salmon, green sturgeon, Delta smelt and longfin smelt.

Changing the rules is "like having a speed limit in a school zone except when you're in a hurry," said Jon Rosenfield, science director of the San Francisco Baykeeper.

"We've got a violation of water quality standards, a petition (by a state and federal agency) to waive those standards, and a governor's executive order encouraging the board to waive those standards through his executive order.

"There's not much difference between a world without environmental laws and a world where, at the stroke of a governor's pen, environmental laws are eviscerated," he said.

But farm groups and water suppliers said the governor's action could bring needed balance to the Delta.

Sarah Woolf, a farmer in the Westlands Water District in the San Joaquin Valley, said that in the past several years, her family has followed roughly half of their land. Her family received zero allocation of Delta water in the last two years and relied almost entirely on groundwater.

Saying that the regulations can be too rigid in dry years, Woolf said the governor's order could provide flexibility in better managing water supplies.

"We're hopeful that this results in more water supply for a higher percentage of the contract water we are able to receive," she said.

Randy Fiorini, a Merced County farmer, said farmers and other water users are routinely deprived of water to protect environmental resources. Now, he said, the governor is tipping the balance in the other direction.

"This gives us the chance to capture as much water now as we possibly can," he said.

Newsom's order says: "To ensure adequate water supplies for purposes of health, safety, the environment, or drought resilient water supplies, the Water Board shall consider modifying requirements for reservoir releases or diversion limitations in Central Valley Project or State Water Project facilities."

His order adds that to enable those actions, two state laws — Water Code Section 13247, which requires state agencies to comply with all water-quality rules, and Public Resources Code, Division 13, which ensures environmental quality, and its regulations — "are suspended."

The order means it's likely that the water board will allow more water to be stored later this year in Lake Shasta and Lake Oroville, the state's largest reservoirs, plus more water to be pumped south into San Luis Reservoir in the San Joaquin Valley. Oroville as of today contains 115.6% of its historic

average and Shasta is at 88.1%. Because of the boost from the storms, the state recently announced that growers and water providers would get 30% of their requested allocations from the state aqueduct — the highest amount for January in six years.

The order also aims to streamline and increase groundwater recharge projects.

In an immediate response to Newsom's order, the state Department of Water Resources and the U.S. Bureau of Reclamation on Monday jointly petitioned the state water board to loosen the Delta flow rules "to ensure the availability of an adequate water supply while also ensuring protection of critical species and the environment."

Water board officials said in an emailed statement to CalMatters that they "are reviewing the request carefully, in coordination with the California Department of Fish and Wildlife." They said the agency's decision will come "within the next week."



Shasta Lake, one of the state's largest reservoirs, is shown in NASA photos in July 2019, November 2022 and on Jan. 29, 2023 (left to right). The reservoir now contains about 88% of its historic average. Satellite image

Newsom has been under heavy criticism in recent years for using his emergency power to issue orders for handling COVID-19, the death penalty and other state issues.

Newsom said in the order that he hopes to help "maintain critical flows for fish and wildlife."

Storing more water could "protect cold water pools for salmon and steelhead" later in the year, the order says. During drought, low reservoir levels can lead to lethally warm water for salmon when they spawn in the summer and fall. Holding water in reservoirs now may help the ecosystem later with improved water quality, enhanced flows and cold water for reproducing salmon.

But Rosenfield and Obegi said fish need substantial flows now. High river flows push young salmon along in their spring journey from the Central Valley to the ocean, while reduced flows lead to higher mortality.

Put in place decades ago, the Delta flow regulations at stake now are designed to help juvenile salmon reach the ocean and protect the Delta from seawater intrusion, which can occur when flows from the Sacramento and San Joaquin rivers are reduced. Many environmentalists say the flow rules aren't strong enough to protect fish, while some water user groups say they allow too much water to flow into the ocean.

Triggered by January's conditions, the rules require that 29,200 cubic feet per second of water flow through the Delta through most of February. But last week, state and federal agencies unveiled a forecast saying flows could drop to 15,000 cubic feet per second. Environmental groups objected in a Feb. 10 letter to the state water board, warning "that the U.S. Bureau of Reclamation and the

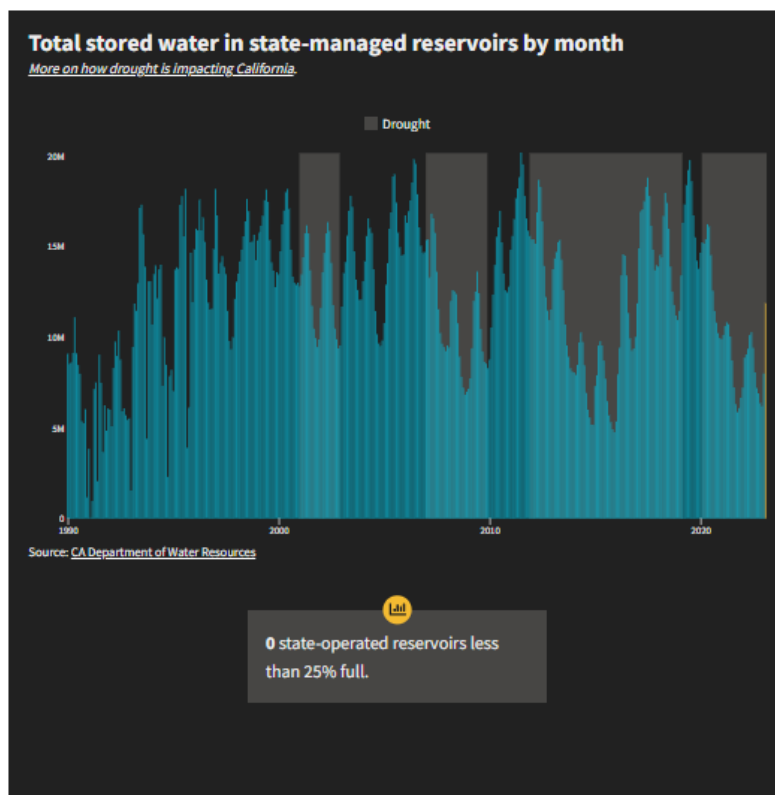
California Department of Water Resources appear likely to violate the minimum Delta outflow requirements.”

Three days later, Newsom issued his order.

Newsom’s order points out that heavy rains in 2021 were followed by the driest January through March in over a century. A similar pattern, he said, is emerging now, with the December and January storms followed by a dry February, so more water needs to be held back in reservoirs to protect cities and farms from another drought-plagued summer.

“[T]he frequency of hydrologic extremes experienced in the State is indicative of an overarching need to continually reexamine policies to promote resiliency in a changing climate,” Newsom stated.

As of Feb. 14, Delta outflow was measured at 18,000 cubic feet per second, which is just 61% of the flow required under the water board’s restrictions.



John McManus, president of the Golden State Salmon Association, said the governor is using excessive executive force.

“Newsom claims he’s using his emergency authority. What emergency is he responding to?” He noted that snowpack is at high levels so it will feed the reservoirs in the spring and provide more water to people and farms.

The January rains were considered a boon for fish and other wildlife. But “now Newsom is stepping in to kill our salmon runs, as well as other wildlife that were hoping to catch a break,” McManus said.

Water providers, however, say that the flow rules are outdated because climate change has dramatically altered water supplies.

Newsom's order "provides flexibility to manage across all these beneficial uses ... whether that's protecting water supply or the environment," said Jennifer Pierre, general manager of the State Water Contractors.

"When you're working with an unknown future, you need to make sure that you're protecting as best you can your ability to keep your options open through the course of the year," she said, adding that 2023 "could be a fourth year of drought."

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Shrinking age distribution of spawning salmon raises climate resilience concerns

Study suggests changes in hatchery practices could help increase population stability for Sacramento River fall-run Chinook salmon, the backbone of California's salmon fishery

UC Santa Cruz | February 27, 2023 | Tim Stephens

By returning to spawn in the Sacramento River at different ages, Chinook salmon lessen the potential impact of a bad year and increase the stability of their population in the face of climate variability, according to a new study by scientists at UC Santa Cruz and NOAA Fisheries.

Unfortunately, spawning Chinook salmon are increasingly younger and concentrated within fewer age groups, with the oldest age classes of spawners rarely seen in recent years. The new study, published February 27 in the Canadian Journal of Fisheries and Aquatic Sciences, suggests changes in hatchery practices and fishery management could help restore the age structure of the salmon population and make it more resilient to climate change.



Scientists measure an adult salmon during a tagging project off the coast near Bolinas. Chinook salmon return to spawn in the Sacramento River at different ages, but spawning salmon are increasingly younger and concentrated within fewer age groups. (Photo by Jeremy Notch)

The researchers focused on Sacramento River fall-run Chinook salmon, which contribute heavily to the salmon fisheries of California and southern Oregon. This population is particularly susceptible to the effects of increasingly severe drought conditions driven by climate change.

“As we get more variable climate conditions, with greater extremes of rainfall and drought, we are going to see more ‘boom-and-bust’ population dynamics unless we start to restore the age structure of the population, which can spread out the effects of good and bad years across time,” said senior author Eric Palkovacs, professor of ecology and evolutionary biology and director of the Fisheries Collaborative Program at UC Santa Cruz.

If most of the salmon return to spawn at the same age, one bad year could be devastating for the overall population. Spreading the risk over multiple years is an example of what ecologists call the “portfolio effect,” like a financial portfolio that spreads risk over multiple investments.

First author Paul Carvalho, a postdoctoral fellow with the Fisheries Collaborative Program, explained that juvenile salmon are especially vulnerable to the effects of drought as they migrate to the ocean from freshwater rivers and streams.

“We focused on the impacts of drought on the survival of juvenile salmon, but drought conditions can also increase mortality of returning adult salmon as they migrate upstream to spawn,” he said.

Carvalho developed a life cycle model of the Sacramento River fall-run Chinook salmon population to simulate the effects of different drought scenarios and other variables on the population. The model

was grounded in data from field studies, such as research by NOAA Fisheries scientists that quantified the relationship between river flows and survival rates of juvenile salmon.

The model allowed the researchers to assess the effects of different mechanisms that can affect the age structure of the population. A century ago, most of the spawning salmon returning to the Sacramento River watershed were four years old, and some were as old as six years. Today, however, six-year-old fish are rarely observed and most of the spawners are three years old.

“Historically, you would have seen huge salmon coming back at older ages, but over the past century they’ve gotten smaller and younger,” Palkovacs said. “The dominant age class is now 3 years, and there are very few even at age 5, so there’s been a big shift in the age structure.”

Decreased size and age at maturity is a classic pattern of fisheries-induced evolution. A high mortality rate for older fish selects for fish that mature at earlier ages, because a fish that dies before it can spawn doesn’t pass on its genes. But fishing pressure is not the only factor driving changes in the age structure of the salmon population. Hatchery practices can also inadvertently select for earlier maturation.

“It’s pretty clear that current hatchery practices are resulting in very homogeneous populations returning at age three,” Palkovacs said. “Rather than producing a uniform product, it would be better to increase the diversity of the age structure by selecting older, larger fish and making sure you get as many of them into the spawning population as possible.”

Carvalho noted that improving the age structure of the population by selecting for fish that spend more years at sea (delayed maturation) would be most effective in combination with reduced harvest rates.

“Because the fish remain in the ocean longer, they are exposed to the fishery and other causes of mortality for a longer period, so that reduces the number returning to spawn if you don’t reduce fishing pressure on those older age classes,” he said.

Overall, the results show that maintaining or increasing the age structure through reduced mortality and delayed maturation improves the stability of the salmon population, buffering against the adverse effects of drought and making the population more resilient in an increasingly variable climate.

“Regardless of the mechanism, whether it’s reduced mortality or delayed maturation that’s driving it, increasing the diversity of the age structure will increase the stability of the population,” Carvalho said.

In addition to Carvalho and Palkovacs, the coauthors of the paper include William Satterthwaite, Michael O’Farrell, and Cameron Speir at the NOAA Southwest Fisheries Science Center. This work was supported by the Cooperative Institute for Marine, Earth, and Atmospheric Systems (CIMEAS) and the NOAA Quantitative Ecology and Socioeconomics Training (QUEST) Program.

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