Veles Water Weekly Report

August 18th 2022

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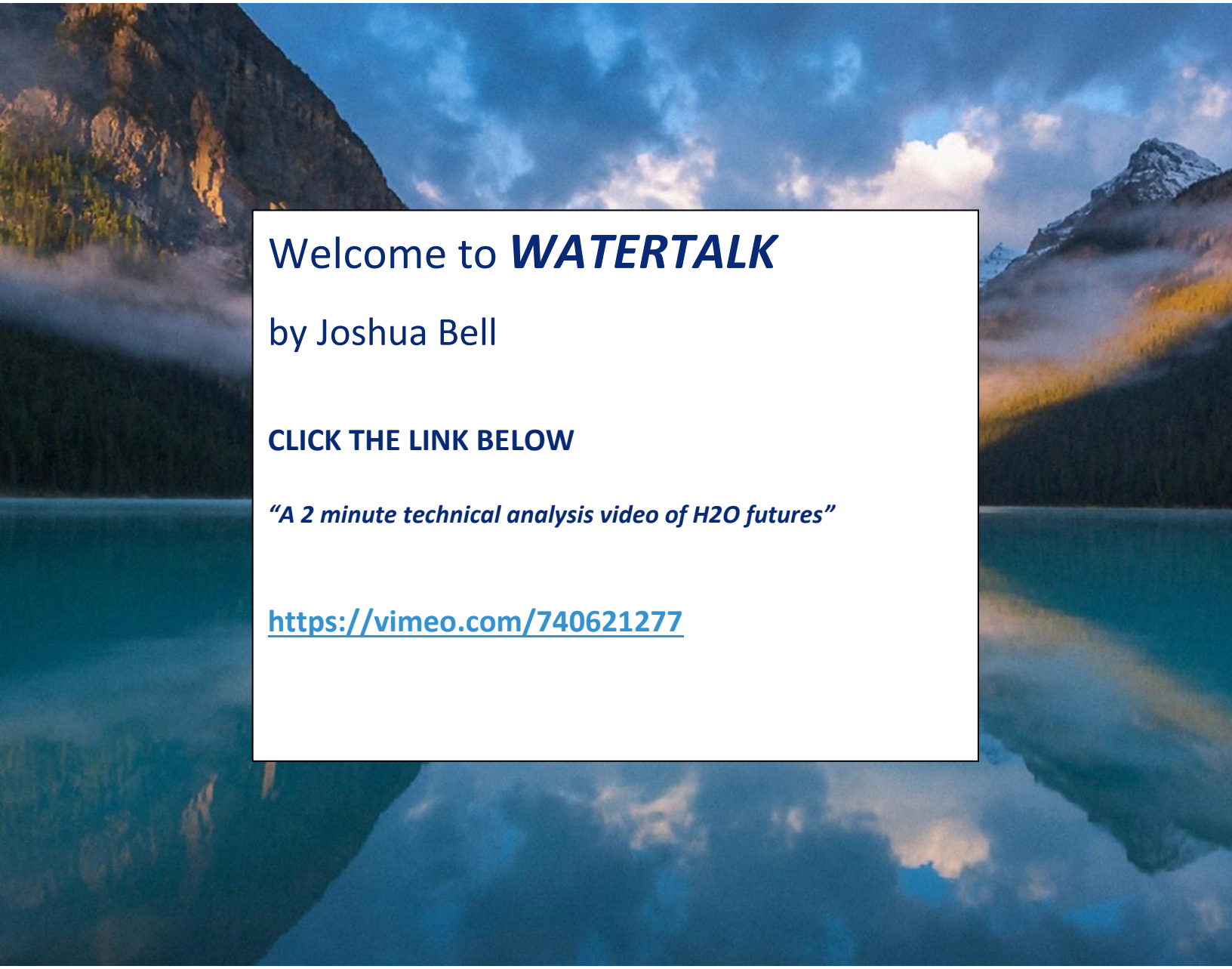
VelesWater

WATER FUTURES MARKET ANALYSIS



Welcome to ***WATERTALK***

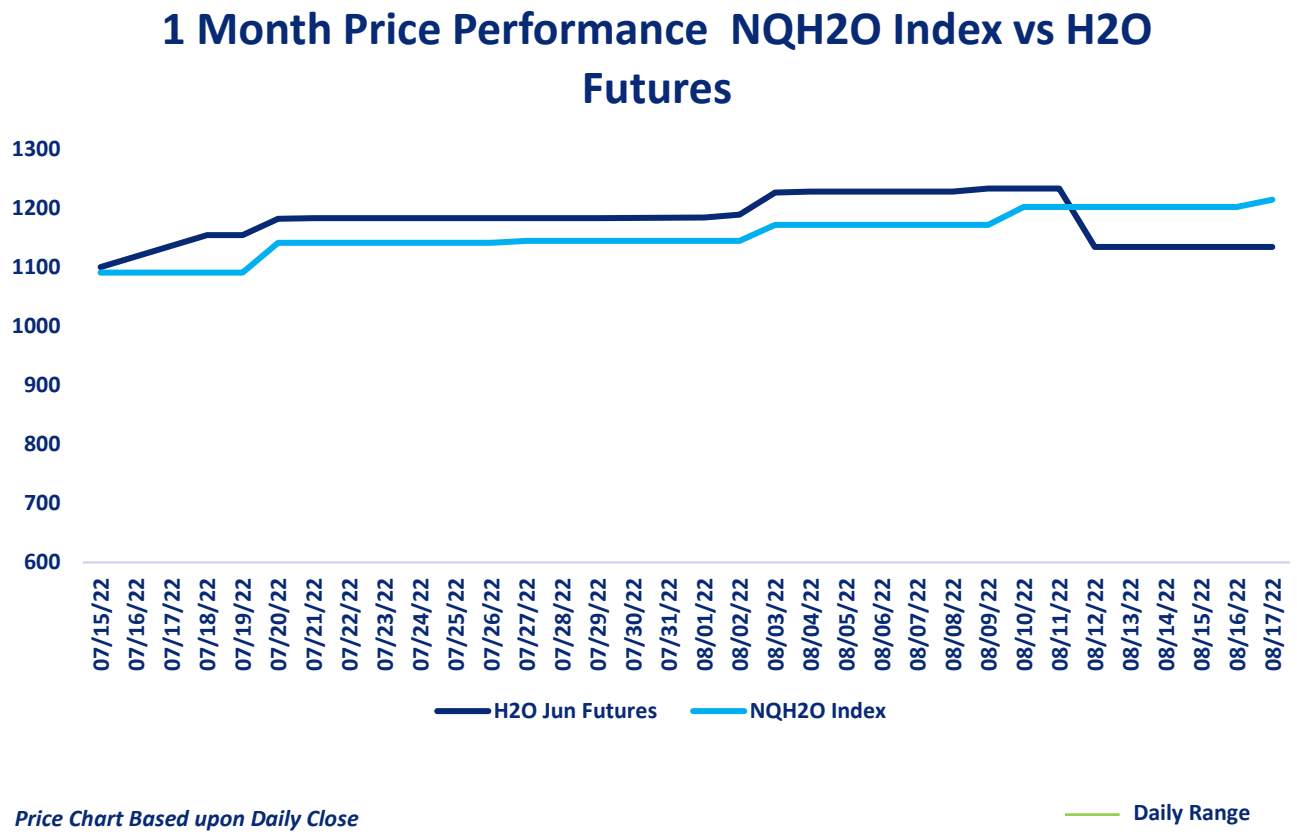
by Joshua Bell

CLICK THE LINK BELOW

"A 2 minute technical analysis video of H2O futures"

https://vimeo.com/740621277

NQH2O INDEX PRICE vs H2O FUTURES PRICE



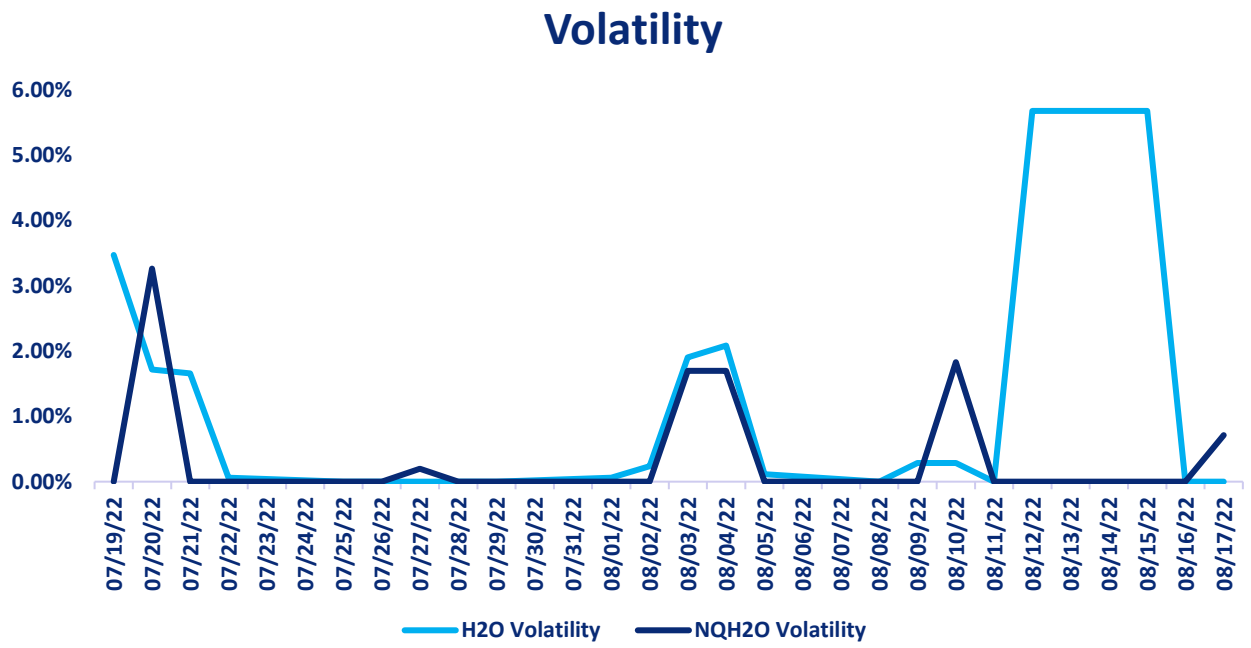
The new NQH2O index level of $1214.06 was published on the 17th of August, up $12.14 or 1.01%, which sets another new all-time high for eleventh week in a row. The August contract has settled at the new index level. The September contract is now considered the front month contract. The futures have been trading at from a premium of $31.08 to a discount of $80.06.

NQH2O is up 71.87% Year to Date.

Below are the bid offer prices on different expiries being quoted in the market.

Sep 22	1130@1150
Dec 22	990@1060
Jun 23	1175@1300

H2O FUTURES AND NQH2O INDEX VOLATILITY ANALYSIS



DAILY VOLATILITY

Over the last week the June daily future volatility high has been 2.90% on August 4th and a low of 0 % on August 8th..

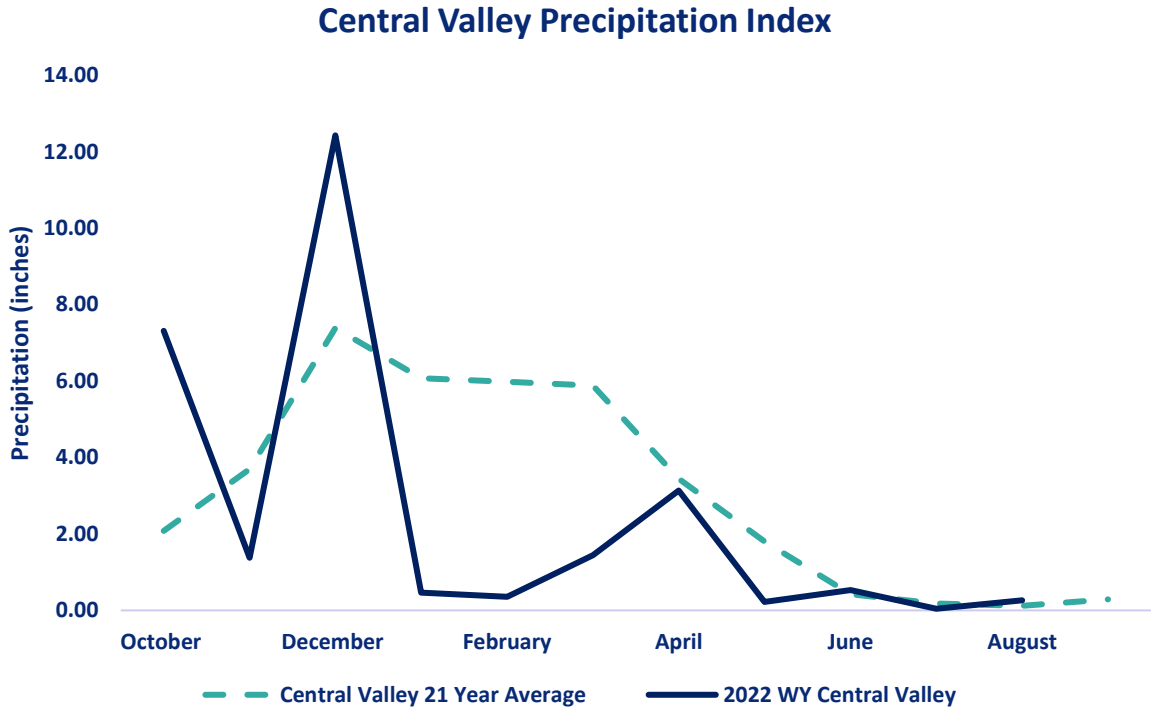
ASSET	1 YEAR (%)	2 MONTH (%)	1 MONTH (%)	1 WEEK (%)
NQH2O INDEX	22.46%	4.89%	2.22%	1.578%
H2O FUTURES	N/A	10.93%	8.82%	8.03%

For the week ending on the August 17th, the two-month futures volatility is at a premium of 6.05% to the index, up 3.79% from the previous week. The one-month futures volatility is at a premium of 6.59% to the index, up 3.71% from last week. The one-week futures volatility is at a premium of 0.89% to the index, up of 5.56% from the previous week.

*Above prices are all **HISTORIC VOLATILITIES** and **IMPLIED VOLATILITIES** will be introduced once an options market has been established. All readings refer to closing prices as quoted by CME.*

VELES WATER WEEKLY REPORT

CENTRAL VALLEY PRECIPITATION REPORT



Central Valley average is calculated using data from 19 weather stations in the Central Valley, California.
Data as of 17/08/2022

STATION	MTD (INCHES)	WEEK ON WEEK CHANGE (INCHES)	% OF 20 YEAR AVERAGE MTD	2022 WYTD VS 2021 WYTD %	2022 WY VS 20 YEAR AVERAGE TO DATE %
SAN JOAQUIN 5 STATION (5SI)	0.28	0.00	227.03	47	63
TULARE 6 STATION (6SI)	0.34	0.00	335.21	35	59
NORTHERN SIERRA 8 STATION (8SI)	0.18	0.00	132.17	44	79
CENTRAL VALLEY AVERAGE	0.27	0.00	231.47	42	67

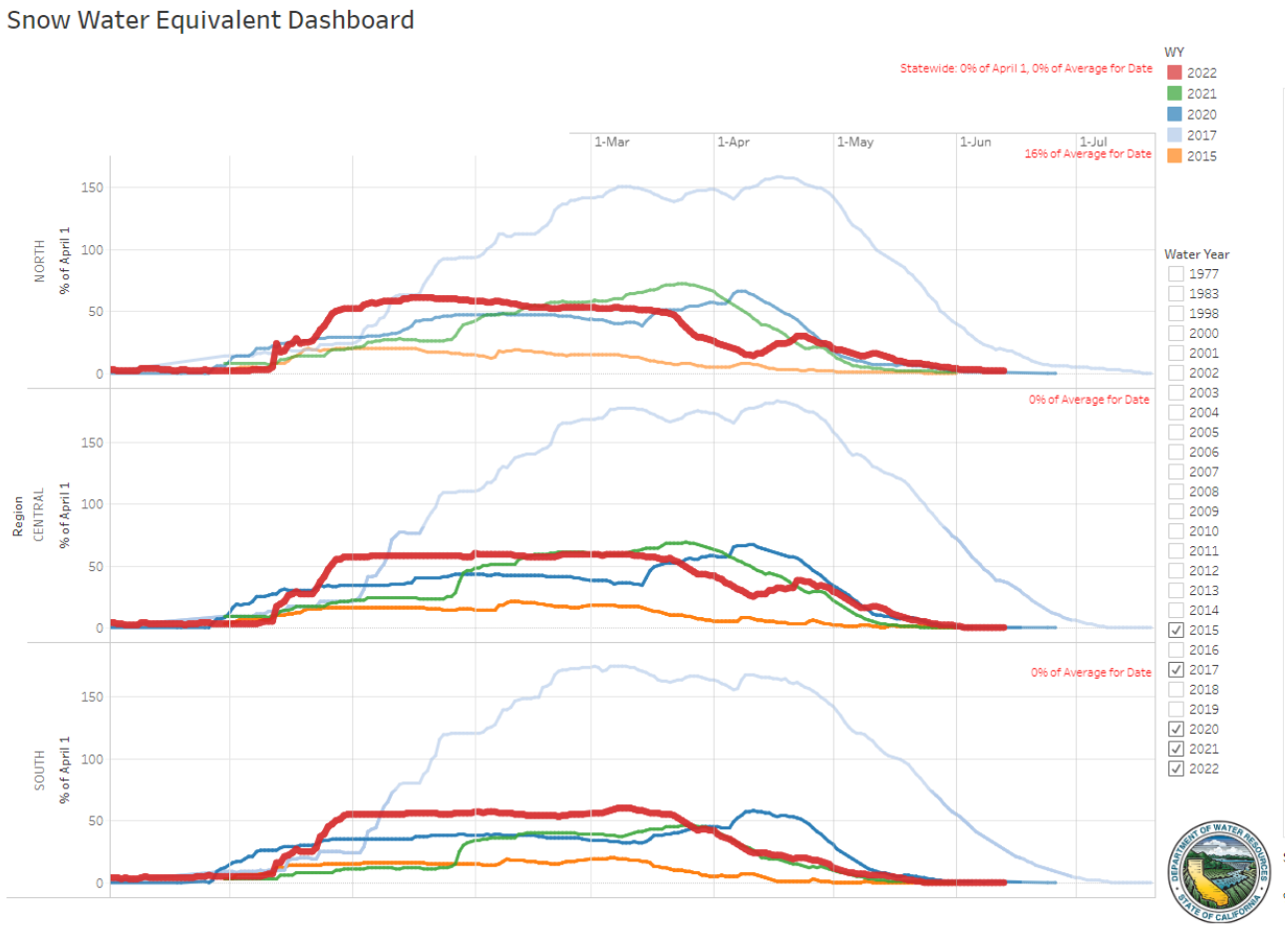
RESERVOIR STORAGE

RESERVOIR	STORAGE (AF)	% CAPACITY	LAST YEAR % CAPACITY	HISTORIC ANNUAL AVERAGE CAPACITY %
TRINITY LAKE	638,184	26	38	38
SHASTA LAKE	1,634,810	36	29	56
LAKE OROVILLE	1,371,082	39	23	62
SAN LUIS RES	604,803	30	16	73

Reference: California Water Data Exchange

VELES WATER WEEKLY REPORT

SNOWPACK WATER CONTENT



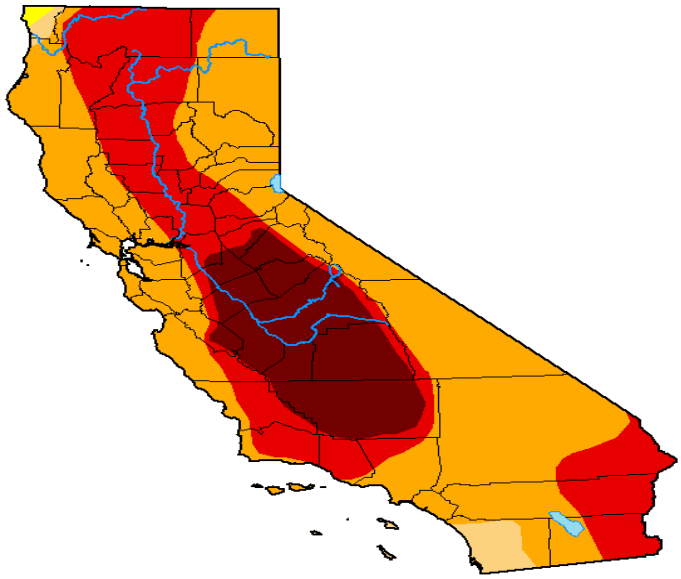
REGION	*SNOWPACK WATER EQUIVALENT (INCHES)	WEEK ON WEEK CHANGE (INCHES)	% OF AVERAGE LAST YEAR	% OF 20 YEAR HISTORICAL AVERAGE	% OF HISTORICAL **APRIL 1ST BENCHMARK
NORTHERN SIERRA	0.4	0.00	0	16	2
CENTRAL SIERRA	0	0.00	0	0	0
SOUTHERN SIERRA	0	0.00	0	0	0
STATEWIDE	0.1	0.00	0	0	0

****Snow Water Equivalent*, **or** SWE**, is a commonly used measurement used by hydrologists and water managers to guage the amount of liquid water contained within the snowpack. In other words, it is the amount of water that will be released from the snowpack when it melts. SWE has regional variance.**

**** April 1st is used as the benchmark as it when the snowpack in California is generally deepest. It has been used the benchmark date since 1941 by DWR and can be used to predict spring river flow.**

VELES WATER WEEKLY REPORT

DROUGHT MONITOR



August 9, 2022
(Released Thursday, Aug. 11, 2022)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	99.77	97.52	45.81	16.53
Last Week 08-02-2022	0.00	100.00	99.78	97.47	59.81	12.12
3 Months Ago 05-10-2022	0.00	100.00	99.86	95.14	59.81	0.00
Start of Calendar Year 01-04-2022	0.00	100.00	99.30	67.62	16.60	0.84
Start of Water Year 09-28-2021	0.00	100.00	100.00	93.93	87.88	45.66
One Year Ago 08-10-2021	0.00	100.00	100.00	95.07	88.37	47.10

Intensity:
- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

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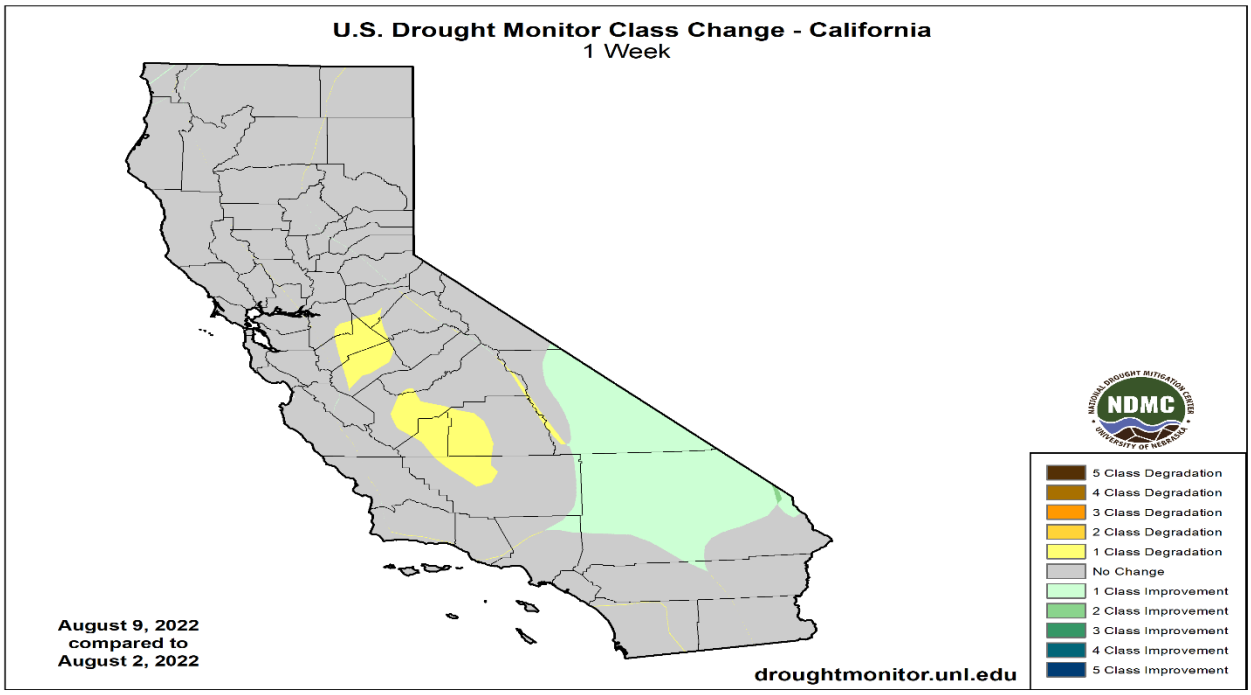
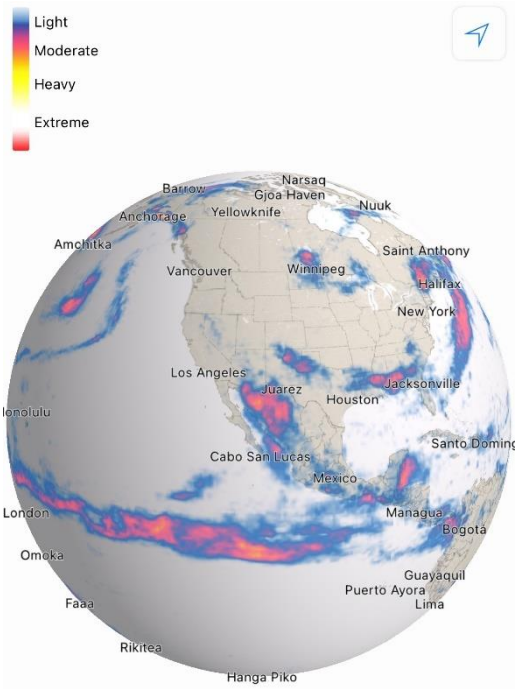


The US Drought Monitor release their statistics with a 1-week lag to this report. Over the past week the has been 0.01% class 1 improvement in D1 drought conditions, 0.05% class 1 degradation in D2 drought conditions 14.00% class 1 improvement in D3 drought conditions and 4.41% class 1 degradation in D4 drought conditions.

The U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. Map courtesy of NDMC.

CURRENT SATELLITE IMAGERY



Map: Dark Sky

The current satellite picture shows two very light storm activity systems over the Northwest Pacific which may bring some light precipitation to the Northwest.

The satellite picture is dominated by the effect of the Monsoon moisture inflow which is bringing welcome relief to many parts of the Southwest.

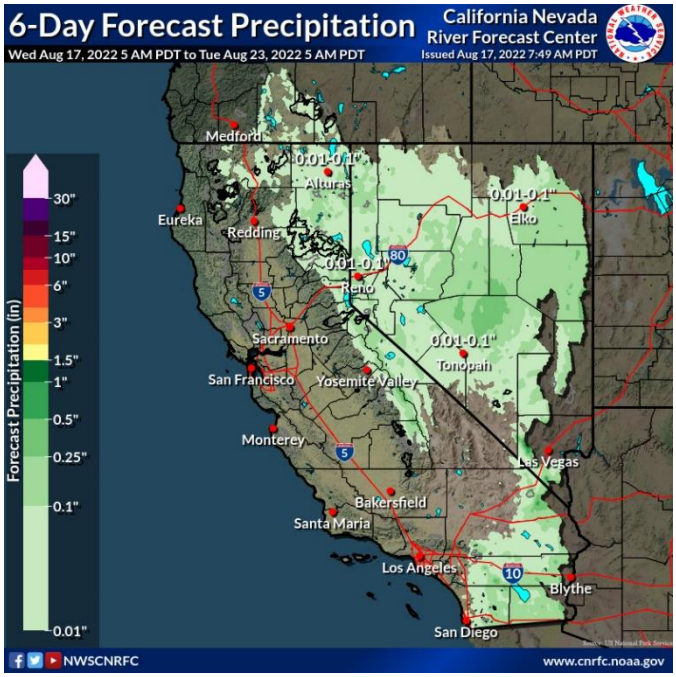
What is unusual is its robust strength and the extent it extends westwards into Eastern California and northwards to Idaho.

The Monsoon effect is also providing moisture to the Midwest .

Separately ,further moisture is coming off the Gulf of Mexico to the Jacksonville area.

We expect Monsoon activity to continue over the next 2 months.

10 Day Outlook



Precipitation amounts will be variable with the thunderstorms. Locally heavy rain possible with some of the thunderstorms and isolated flash flooding possible, mainly with the storms over NV and SE CA. High pressure builds into the region from the Eastern Pacific Friday into Saturday as the low pushes to the east in the Great Basin for showers and thunderstorms retreating back to SE CA and into Srn and Eastern Nevada. Upper level shortwave trough approaches the Pac NW Sunday into Monday bringing more southwest flow for a drier forecast with only a few showers possible over SE CA and Srn NV on Sunday. Temperatures near to around 15 degrees above normal then slight cooling into the weekend and Monday.

Reference: National Weather Service / California Nevada RFC / Sacramento CA

WESTERN WEATHER DISCUSSION

The North American Monsoon remained robust in early August. This is continuing to bring slow relief to a region long affected by entrenched drought. Tropical moisture from the monsoon circulation reached unusually far west this past week, into the southern Great Basin and southeastern California. As a result, exceptional amounts of rain fell on the southern half of Nevada and southeastern California, resulting in a very broad area of 1-category improvement. The record rains in Death Valley brought severe flash flooding that closed about 85 miles of road for several days, making many spots in the Valley unreachable. Farther east, rainfall was less remarkable, but still above normal, improving conditions across parts of New Mexico, southeastern Arizona, and parts of the southeastern quarter of Utah. Most locales in Arizona, New Mexico, the California deserts, southern Nevada, and a few other scattered areas have measured at least 200 percent of normal over the past 2 months. Portions of southeastern California, the Sonoran Desert, southwestern and northeastern Arizona, and a large area in northwestern New Mexico have been doused by 3 to 5 times normal rainfall. Farther north, central sections of Washington and Oregon also saw dryness and drought ease a little bit. The only area currently headed in the opposite direction is central and northern Montana. They are considerably wetter than normal for the past 60 days as a whole, but conditions have been changing rapidly since then. Rainfall has become scarce and temperatures have averaged well above normal. All this resulted in a significant expansion of D0 and D1 conditions into eastern and central Montana, although little change was noted in the areas already entrenched in severe to extreme drought.

Reference:

Richard Tinker, NOAA/NWS/NCEP/CPC
Denise Gutzmer, National Drought Mitigation Center

WATER NEWS

CALIFORNIA WATER NEWS

Four things to know about Colorado River water in California

Arizona and Nevada will face steeper cuts to Colorado River water in 2023 as drought continues to deepen, but California will once again be spared — at least for now.

The US Bureau of Reclamation today announced the first-ever Level 2a shortage condition for Lake Mead, the massive reservoir that supplies water to about 25 million people. That designation triggers more curtailments for Arizona, Nevada and Mexico, while California, which holds more senior rights, is not affected.

But there's been no deal among the Colorado River basin states to further cut their water use by 2 to 4 million acre feet in 2023. It's a massive amount — at least seven times more than Nevada is entitled to in a year.

In mid-June, Bureau Commissioner Camille Calimlim Touton gave the states a 60-day deadline to craft a deal, or face federally-mandated cuts instead.

As of today, no agreement had been struck. But the deadline has come and gone with no plan and no concrete consequences from the Bureau of Reclamation.

"To date, the states collectively have not identified and adopted specific actions of sufficient magnitude that would stabilize the system," Touton said.

The verdict is especially high-stakes for Southern California, where the river provides a quarter or a third of the region's water supply. Seven Southern California counties rely on the river for water and hydroelectric power, and 600,000 acres of farmland draw on it for irrigation.

"Our region, our economy, our way of life in Southern California depends on the Colorado River," said Bill Hasencamp, Colorado River resources manager for the giant Metropolitan Water District, which supplies imported water to 19 million people. "It is vitally important."

But climate change, drought and overallocation have been threatening the Colorado River's supply for decades, even as the amount consumed and lost through reservoir evaporation regularly outpaces its natural flows.

And now, with Lake Mead and Lake Powell at historically low levels, more needs to be done, Touton warned. "The system is approaching a tipping point. And without action, we cannot protect the system and the millions of Americans who rely on this critical resource," Touton said today.

What exactly "more" means — and what that means for California — is still an open question. Here's what to know:

California gets the most of any state

VELES WATER WEEKLY REPORT

The Colorado River and its tributaries cut through seven U.S. states and Mexico, from the river's headwaters in Colorado and Wyoming to where it trickles toward — though rarely actually reaches — the Gulf of California.

A century of deals, acts and legal decisions have carved up 15 million acre-feet between Colorado, Wyoming, Utah and New Mexico in the Upper Basin, and California, Arizona and Nevada in the Lower Basin. Native American tribes hold rights to this water as well, and a 1944 treaty set aside another 1.5 million acre feet for Mexico.

The biggest straw, by far, is California's. The state is entitled to 4.4 million acre-feet, or more than a third of the river's natural flow. It's enough water to supply more than 13 million Southern California households for a year. In the Lower Basin, Arizona comes in next with about 2.8 million acre feet.

Most of California's Colorado River water is used for irrigation. The Imperial Irrigation District gets as much as 3.1 million acre feet a year, mostly supplied to nearly 475,000 acres of farmland and a handful of communities in the southeastern corner of California. Another major recipient is the Metropolitan Water District, which last year diverted roughly 1.1 million acre feet of water from the Colorado River system.

"(For) 81 years now, it's been the backbone of our supply," Metropolitan's Hasencamp said. "Today, on average, about half of our imported water is from the Colorado River."

Bottom of Form

In 2019, the Upper and Lower Basin states struck agreements laying out who gets cut in the event of water shortages. The Lower Basin's Drought Contingency Plan, in place through 2026, allowed for cuts to California's deliveries for the first time.

Arizona and Nevada, with more junior rights than the Golden State's, start seeing cutbacks when water levels in Lake Mead drop to 1,090 feet; California's cutbacks start when water levels hit between 1,040 and 1,045 feet. Lake Mead, the largest reservoir in the United States, is projected to drop to less than 1,040 feet by the close of 2022.

"California — by virtue of the legal structures — is in a relatively good position on paper," said John Fleck, director of University of New Mexico's Water Resources Program and author of two books about the Colorado River.

"But the problem is that 'on paper' is not the reality now."

The river's reservoirs are at a historic low

Drought has been parching the Colorado River basin for more than two decades. Even in years with close to normal levels of precipitation, less runoff is reaching the river — the result of increasing temperatures and drier soils drinking up the flows as climate change continues.

"We're just not seeing the benefits that we used to that we once had to surface water, streamflow runoff and reservoir storage," Christopher Harris, executive director of the Colorado River Board of California, said at a June meeting of the State Water Resources Control Board. "It's definitely impacted the reservoir system significantly."

Last summer, the U.S. Bureau of Reclamation called the first level-one shortage for the Lower Basin states, prompting cuts to Arizona, Nevada and Mexico — but not California.

At the end of July, levels in Lake Mead, according to NASA, "stand at their lowest since April 1937, when the reservoir was still being filled for the first time."

The Colorado River is critical to the Imperial Valley

For the Imperial Irrigation District, the Colorado River is "our only source of water. We live in a desert. And that's it," said Robert Schettler, a spokesperson for the Imperial Irrigation District. Now, he said, "the onus is to generate a lot of water, rather quickly."

Schettler laid out two strategies for conservation: The first, he said, is farms conserving more with use of efficient strategies such as drip irrigation. "That may take some money, and then it may take a little while to get that water."

Another possibility is fallowing fields — paying farmers to leave fields dry. It's a strategy that the Imperial Irrigation District has employed in the past, but it's unpopular, Schettler said.

"Fallowing is like the F word around here," he said.

Southern Californians could face more restrictions

The cuts could have ripple effects across the entire state's water portfolio. Southern California's other sources of imported water from the northern half of the state are low, too, after several years of drought.

"What do we do when both systems are stressed out? And how do we manage ourselves?" Harris asked at a state water board meeting in June.

For the region served by the Metropolitan Water District, which has characterized the negotiations as difficult, "every type of water user could be affected, including urban and agricultural uses," according to a recent district board presentation.

The Metropolitan Water District has already implemented unprecedented watering restrictions for the 6 million Southern Californians who rely on the parched State Water Project, which funnels water from Northern California south and this year reduced deliveries to just 5% of requested supplies.

The district warned customers that receive Colorado River water that they could face restrictions as soon as next year.

"The areas that get water from the Colorado River are also going to have to conserve more," Hasencamp said. "We're going to have to, because we know we're going to get less water in the future than we're getting today. How much less we don't know."

California has seen federal cuts before — about 20 years ago, after water users failed to reach an agreement to cut back by 800,000 acre feet and stay within its 4.4 million acre-foot allocation.

"Importantly for the future of water agreements in the basin, despite predictions of doom, California absorbed the reductions with only modest impact," reported Fleck and

Anne Castle, a former assistant secretary for water and science at the U.S. Department of the Interior.

Eventually California water systems hashed out a deal. And now, Metropolitan's Hasencamp said, it's time to do so again.

"I think we're going to be in a permanent state of shortage into the future. And the question isn't 'if' anymore," he said: It's how big. "How big of a shortage are we going to have to endure? How big of cutbacks are we going to have to live with?'"

Original Article: Cal Matters by Rachel Becker

Is SGMA Compatible with Farmland Preservation?

As implementation of the Sustainable Groundwater Management Act (SGMA) gets underway, questions are emerging about what it will mean for lands protected under the Williamson Act, California's chief farmland preservation policy. For nearly 60 years, the Williamson Act has helped protect 16 million acres—roughly half of the state's crop- and rangelands—from development. But as SGMA's limitations on groundwater extraction go into effect—and as warmer, more intense droughts begin to push land out of irrigation–the context within which the program operates is shifting. In July, we gathered a group of agriculture, solar, and county stakeholders to explore the interplay between the Williamson Act and SGMA in the San Joaquin Valley. Here is what we learned.

What is the Williamson Act?

First enacted in 1965, the Williamson Act authorizes local governments to sign contracts with private landowners that restrict the use of the land to agriculture or open space. In turn, the property's tax assessments are reduced by 20% to 75%.

These agreements have minimum 10-year terms and automatically renew each year. To terminate a contract, landowners can initiate "nonrenewal"—a process that takes nine or more years, depending on contract length. Alternatively, landowners may request cancellation, a faster option that requires the landowner to pay a hefty fee.

Until 2009, when California was hit hard by the Great Recession, the state compensated participating cities and counties for their lost tax revenues. Most local governments have maintained their programs and several have used a 2011 law (AB 1265) to recoup some revenue by reducing the tax benefit offered to landowners. The amount of enrolled acreage has been fairly stable. In the San Joaquin Valley, Williamson Act contracts still cover 75% of irrigated lands and 46% of non-irrigated lands. This may begin to change, however, as the combined effects of climate change and SGMA implementation motivate Williamson Act contractors to convert their irrigated farmlands to other uses—including water-limited agriculture, habitat restoration, and solar—or to retire the lands entirely.

VELES WATER WEEKLY REPORT

What happens to Williamson Act land that loses water needed to keep farming?

The prospect of SGMA prompting at least half a million acres of cropland (>10%) in the Valley to come out of irrigation by the early 2040s has brought this question to the fore. The answer varies by county and continues to evolve. Broadly speaking, stakeholders in our workshop expressed a desire not to penalize farmers for losing water due to SGMA.

Some alternative uses will likely be compatible with existing contracts: water-limited farming, including dryland cropping and grazing, would remain eligible. Much non-irrigated land is already enrolled in the program, and local governments could use existing contracts to authorize a conversion to other uses. Habitat restoration, groundwater recharge, and land fallowing with cover cropping may qualify as open space. In addition, local governments may authorize cancellation in cases where water is no longer available to the participating landowner. Some counties (e.g. Kern) have begun to do this, although the decision is subject to California Environmental Quality Act (CEQA) regulations and involves a fee.

What about solar?

For solar, it's more complicated. Solar is a relatively lucrative alternative land use, and the state's renewable energy targets under SB 100 will require an unprecedented build-out in the same timeline as SGMA implementation. Much of the farmland that is suitable for solar is subject to Williamson Act contracts—including roughly 70% in the San Joaquin Valley. While some counties (e.g. Kern and Fresno) do not consider utility-scale solar as compatible with the Williamson Act, others (e.g. Kings and Tulare) allow it under some circumstances. Landowners who cannot develop solar as a compatible use can pursue cancellation, but the fees can be large.

As for rural county income, California's solar property tax exclusion means that building solar on farmlands will not substantially increase property tax revenues, even if the lands lose their Williamson Act tax advantage. However, this could change in coming years; a legislative proposal now under consideration would extend and then reduce this exclusion to 50% beginning in FY 2026.

How can the Williamson Act meet its goals in a changing environment?

Overall, the Williamson Act remains popular; counties and landowners strongly support its continuation. But some adjustments could help the program meet its objectives in a changing environment. Legislation clarifying local governmental authority to 1) designate alternative land uses as eligible open space, or 2) cancel contracts where land retirement is the result of SGMA implementation or chronic shortages in surface water supplies, would be helpful steps. This legislation could include expedited CEQA review and waiver of the cancellation fee under these circumstances. Flexibility will be needed for lands that lose their water in the coming decades—legislation may be needed to make these adjustments explicit.

Original Article: PPIC by Annabell Rosser

Climate change doubles likelihood of 'megaflood' in California: study

The likelihood of a "megaflood" occurring in California has doubled due to climate change, according to a new study published on Friday.

The study, published in the Science Advances journal, found an increased likelihood of runoff water occurring from harsher storms, creating the threat of debris flows and landslides later, according to a press release from the University of California, Los Angeles (UCLA).

With every degree the Earth gets warmer, the risk for a "megaflood" increases, the study found.

Researchers looked at two different scenarios using present climate models and high-resolution weather modeling. One scenario involved a long series of storms taking place during what scientists predicted climate conditions would be like between 2081 and 2100.

The other scenario predicted what it would be like if those storms took place in the current climate, according to the release.

In the Sierra Nevada, storms that took place toward the end of the century would see between 200 percent and 400 percent more runoff because of higher precipitation.

"There are localized spots that get over 100 liquid-equivalent inches of water in the month," UCLA climate scientist and co-author of the research Daniel Swain said in a statement regarding the end-of-the-century scenario.

"On 10,000-foot peaks, which are still somewhat below freezing even with warming, you get 20-foot-plus snow accumulations. But once you get down to South Lake Tahoe level and lower in elevation, it's all rain. There would be much more runoff," he added.

The researchers also noted that the state risks a $1 trillion disaster. In addition, parts of major cities such as Los Angeles and Sacramento would be underwater if the state endured the kind of flooding that took place during the Great Flood of 1862 in the current climate.

Planned Parenthood to spend record $50m ahead of midterm electionsElon Musk featured at Kevin McCarthy's GOP retreat in Wyoming

"Modeling extreme weather behavior is crucial to helping all communities understand flood risk even during periods of drought like the one we're experiencing right now," Karla Nemeth, director of the California Department of Water Resources, said in a statement.

"The department will use this report to identify the risks, seek resources, support the Central Valley Flood Protection Plan, and help educate all Californians so we can understand the risk of flooding in our communities and be prepared," she added.

Original Article: The Hill by Caroline Vakil

Newsom: California must boost water recycling, desalination

California should invest tens of billions of dollars in water recycling, storage and desalination over the next two decades to shore up its supply as the state gets drier and hotter, Gov. Gavin Newsom said in a proposal released Thursday. It comes as drought continues to grip the U.S. West and the state prepares to lose 10% of its water supply by 2040, according to projections by the Department of Water Resources. The Democratic governor discussed the proposal at the construction site of a plant to remove salts from river water that should be fresh, the type of project he said the state needs more of in the coming years. His proposed water recycling targets, which would make treated waste water safe for drinking, would cost $27 billion by 2040, his proposal said. That was the biggest price tag associated with the plan, which also relies on billions in money already approved in past state budgets. The plan envisions that money coming from both state and federal sources. In total, he wants to boost annual water supply by nearly 3 million acre feet each year; one acre foot can supply about two households. His plan also calls to expand water storage, in above-ground reservoirs and underground aquifers, by about 4 million acre feet — nearly enough water to fill Shasta Lake, the state's largest reservoir. New storage infrastructure would help the state capture more water during times of heavy rain, like the two large storms California saw last October and December. The proposal comes amid the third year of a drought, the state’s second in the past decade. Most of the state’s major reservoirs are far below normal levels after the state saw its driest January through March in at least a century. That’s typically when most of the state’s rain and snow falls. Meanwhile the Colorado River, a key source of water for Southern California, has reached critically low levels. The Newsom administration hopes to reduce dependence on the river and other water exports. “We're focused on creating more water," he said. Interest in water recycling is expanding across the West as states and cities see their water supplies threatened by extended droughts. About two dozen communities, including those in Nevada and Colorado, rely on some recycled water for drinking, but that number is expected to grow The Metropolitan Water District of Southern California, which provides water for nearly half the state's residents, is building a massive water recycling project. Congress included $1 billion for water reuse projects in the West in the infrastructure bill passed last year. The plan doesn't have any revolutionary ideas for water management, but includes key details about how the state can “move faster on some of the good ideas," said Ellen Hanak, vice president and direct of the Water Policy Center at the Public Policy Institute of California. For water recycling, its important to not just have the technology but to ensure there is a place to put the water after its treated or appropriate regulations to make sure it can safely be put directly back into the water supply, she said. Newsom's plan calls on the State Water Resources Control Board to create regulations for that direct reuse by the end of next year. The new proposal doesn't call for any immediate, mandatory cuts to water use in cities or on farms. Instead, he wants the water board to

develop efficiency targets for every district, but they would only take effect next spring if there's another dry winter. He's also proposing spending $1 billion to get rid of 500,000 square feet of turf. He previously directed the state's more than 400 local water districts to implement their own plans to reduce water use and has set a few statewide policies, like a ban on watering decorative grass. He has not set a statewide water reduction mandate. Newsom also said he wants the Legislature to consider a law that would let the state curtail people's water rights even when its not a drought. The state operates an archaic system of water rights to govern how much water cities, farms and others are entitled to take and from where. An effort is underway to digitize records that spell out those terms, some more than a century old. Desalination would make up only about 3% of the added water supply Newsom is calling for, most of it coming from brackish water, which isn't as salty as water that comes from the ocean. His plan doesn't spell out how much water would come from removing salt from ocean water, a more controversial practice, but he's calling on various state agencies to create a process for citing such projects by 2023. "As California becomes hotter and drier, we must become more resourceful with the strategic opportunity that 840 miles of ocean coastline offer to build water resilience," the plan said. He's not proposing any new money to boost water storage, instead working to speed up projects that have already been proposed. The state has already put $350 million aside for hundreds of projects aimed at making it easier to recharge groundwater storage. He's also committing to pushing forward with seven water storage projects funded by a 2014 bond that voters passed, including a delayed reservoir project. State Sen. Brian Dahle, a Republican running against Newsom in this fall's election, said he supports building more reservoirs, water recycling and desalination, but that he doubts the governor's plan will come with real follow through. He pointed to the fact that no projects have been completed with the bond money the state passed eight years ago. "When do the people wake up and go, 'I want results. I actually want some results and I want to stop being promised and charged for non-results,'" he said.

Original Article: Thew News and Observer by Kathleen Ronayne, AP

US WATER NEWS

Interior Department Announces Actions to Protect Colorado River System, Sets 2023 Operating Conditions for Lake Powell and Lake Mead

As the worsening drought crisis continues to impact communities across the West, the Department of the Interior today announced urgent action to improve and protect the long-term sustainability of the Colorado River System, including commitments for continued engagement with impacted states and Tribes. The Bureau of Reclamation also released the Colorado River Basin August 2022 24-Month Study, which sets the annual

operations for Lake Powell and Lake Mead in 2023 in light of critically low reservoir conditions.

Prolonged drought and low runoff conditions accelerated by climate change have led to historically low water levels in Lakes Powell and Mead. Over the last two decades, Department leaders have engaged with Colorado River Basin partners on various drought response operations. However, given that water levels continue to decline, additional action is needed to protect the System.

In addition to the actions being announced today, the Biden-Harris administration is making unprecedented investments in drought resilience and water management. President Biden's Bipartisan Infrastructure Law makes a historic $8.3 billion investment to address water and drought challenges and invest in our nation's western water and power infrastructure, while rebuilding our existing projects to withstand a changing hydrology. Additionally, the recently passed Inflation Reduction Act includes $4 billion in funding specifically for water management and conservation efforts in the Colorado River Basin and other areas experiencing similar levels of drought.

"The worsening drought crisis impacting the Colorado River Basin is driven by the effects of climate change, including extreme heat and low precipitation. In turn, severe drought conditions exacerbate wildfire risk and ecosystems disruption, increasing the stress on communities and our landscapes," said Deputy Secretary Tommy Beaudreau. "The Biden-Harris administration is taking an all-of-government approach to mitigating the drought, and the Interior Department is committed to using every resource available to conserve water and ensure that irrigators, Tribes and adjoining communities receive adequate assistance and support to build resilient communities and protect our water supplies."

"Every sector in every state has a responsibility to ensure that water is used with maximum efficiency. In order to avoid a catastrophic collapse of the Colorado River System and a future of uncertainty and conflict, water use in the Basin must be reduced," said Assistant Secretary for Water and Science Tanya Trujillo. "The Interior Department is employing prompt and responsive actions and investments to ensure the entire Colorado River Basin can function and support all who rely on it. We are grateful for the hardworking public servants who have dedicated their lives to this work, and who are passionate about the long-term sustainability of Basin states, Tribes, and communities."

"The solution to our challenges relies on the bedrock of a century of collaboration and partnership in the Colorado River Basin. But as water stewards, it is our responsibility to protect the system and the millions of Americans who depend on it. Today, Reclamation starts the process on actions we can take to deliver on those responsibilities," said Bureau of Reclamation Commissioner Camille Calimlim Touton. "Reclamation remains fully committed to working in a consensus manner across the Upper and Lower Basins, with Tribes, and with the country of Mexico. I am confident that, by working

together, we can achieve meaningful change toward a sustainable future for the river that serves as the lifeblood of the American West."

2023 Operations of Lake Powell and Lake Mead

Given the 23-year ongoing historic drought and low runoff conditions in the Colorado River Basin, downstream releases from Glen Canyon and Hoover Dams – which created Lakes Powell and Mead – will be reduced again in 2023 due to declining reservoir levels. In the Lower Basin, the reductions represent the second year of additional shortage declarations, demonstrating the severity of the drought and critically low reservoir conditions.

The key determinations from the August 2022 24-Month Study include:

Lake Powell will operate in the Lower Elevation Balancing Tier in water year 2023 (Oct. 1, 2022, through Sept. 30, 2023). The 24-Month Study projects Lake Powell's Jan. 1, 2023, water surface elevation to be 3,521.84 feet – 178 feet below full pool (3,700 feet) and 32 feet above minimum power pool (3,490 feet). The August 24-Month Study projects that Lake Powell will likely release 7 million acre-feet in water year 2023 with the potential for Powell releases to range between 7 to 9.5 maf during water year 2023, depending on hydrologic conditions, as Lake Powell and Lake Mead balance storage contents under the Lower Elevation Balancing Tier.

The Department will evaluate hydrologic conditions in April 2023 and will implement the Interim Guidelines Section 7.D by limiting water year 2023 releases (with a minimum of 7.0 maf) to protect Lake Powell from declining below 3,525 feet at the end of December 2023.

Lake Mead will operate in its first-ever Level 2a Shortage Condition in calendar year 2023 (Jan. 1, 2023, through Dec. 31, 2023). The August 24-Month Study projects Lake Mead's Jan. 1, 2023, operating determination elevation to be 1,047.61 feet, which is calculated by taking Lake Mead's projected end of calendar year 2022 physical elevation (1,040.78 feet) and adding the 480,000 acre-feet of water held back in Lake Powell to Lake Mead's capacity to maintain operational neutrality. The projected elevation of 1,047.61 feet reflects a Level 2a Shortage Condition, within the DCP elevation band of 1,045 and 1,050 feet, with required shortage reductions and water savings contribution for the Lower Basin States and Mexico, pursuant to Minute 323, as follows:

Arizona: 592,000 acre-feet, which is approximately 21% of the state's annual apportionment

Nevada: 25,000 acre-feet, which is 8% of the state's annual apportionment

Mexico: 104,000 acre-feet, which is approximately 7% of the country's annual allotment

There is no required water savings contribution for California in 2023 under this operating condition.

In May 2022, drought operations to protect Lake Powell were implemented under the Upper Basin Drought Response Operations Agreement, and Glen Canyon Dam releases were reduced under the 2007 Interim Guidelines, which together provided

approximately 1 million acre-feet of additional water to help protect water levels at Lake Powell. Building on these important responsive actions, Reclamation will begin efforts to modify low reservoir operations at both Lake Powell and Lake Mead to be prepared to reduce releases from these reservoirs in 2024 to address continued drought and low runoff conditions in the Basin.

Reclamation will continue to implement the applicable provisions of the 2007 Colorado River Interim Guidelines for Lower Basin Shortages and coordinated operations for both reservoirs: Minute 323 to the 1944 U.S. Mexico Water Treaty; and the 2019 Drought Contingency Plans.

Call for Basin-Wide Conservation

In recent months, Reclamation has shared updated information documenting the increasing risks that will continue to impact Lake Powell and Lake Mead. Reclamation's "Protection Volume Analysis" details that, depending on future snowpack and runoff, a range of actions will be needed to stabilize elevations at Lake Powell and Lake Mead over the next four years (2023-2026). The analysis shows, depending on Lake Powell's inflow, that the additional water or conservation needed ranges from 600,000 acre-feet to 4.2 maf annually.

In June 2022, Commissioner Touton testified before the U.S. Senate Committee on Energy and Natural Resources and called on water users across the Basin to take actions to prevent the reservoirs from falling to critically low elevations that would threaten water deliveries and power production. Reclamation is using the best available science and actively collaborating with water users across the Basin to determine the best ways to meet this increased conservation need.

Accordingly, in addition to undertaking preliminary work to develop the post-2026 strategies and operations, as several reservoir and water management decision documents expire at the end of 2026, Reclamation will immediately initiate a number of administrative actions in the Basin.

In the Upper Basin, Reclamation will:

Take administrative actions needed to authorize a reduction of Glen Canyon Dam releases below 7 million acre-feet per year, if needed, to protect critical infrastructure at Glen Canyon Dam.

Accelerate ongoing maintenance actions and studies to determine and enhance projected reliability of the use of the river outlet works, commonly referred to as the bypass tubes, at Glen Canyon Dam for extended periods.

Support technical studies to ascertain if physical modifications can be made to Glen Canyon Dam to allow water to be pumped or released from below currently identified critical and dead pool elevations.

Continue to work with the Basin states, Basin Tribes, stakeholders and partners to be prepared to implement additional substantial releases from Upper Basin Reservoirs to

help enhance reservoir elevations at Lake Powell under the Drought Contingency Plan's Drought Response Operations Agreement.
Invest in system conservation and voluntary agreements.
Consider other operational actions to establish flexibility in Upper Basin operations at Reclamation facilities.
In the Lower Basin, Reclamation will:

Take administrative actions needed to further define reservoir operations at Lake Mead, including shortage operations at elevations below 1,025 feet to reduce the risk of Lake Mead declining to critically low elevations.
Prioritize and prepare for additional administrative initiatives that would ensure maximum efficient and beneficial use of urban and agricultural water, and address evaporation, seepage and other system losses in the Lower Basin.
Support technical studies to ascertain if physical modifications can be made to Hoover Dam to allow water to be pumped/released from elevations below currently identified dead pool elevations.
Invest in system conservation and voluntary agreements.
Consider other operational actions to establish flexibility in Lower Basin operations at Reclamation facilities.
The Department's approach will continue to seek consensus support and will be based on a continued commitment to engage with partners across the Basin states, Tribes and the country of Mexico to ensure all communities that rely on the Colorado River will provide contributions toward the solutions.
Original Article: USBR

How the Western drought is pushing the power grid to the brink

It takes a lot of water to make power.
From spinning turbines to hydraulic fracturing to refining fuel, the flow of water is critical to the flow of electrons and heat. About 40 percent of water withdrawals — water taken out of groundwater or surface sources — in the United States go toward energy production. The large majority of that share is used to cool power plants. In turn, it requires energy to extract, purify, transport, and deliver water.
So when temperatures rise and water levels drop, the energy sector gets squeezed hard. The consequences of water shortages are playing out now in swaths of the American West, where an expansive, decades-long drought is forcing drastic cuts in hydroelectric power generation. At the same time, exceptional heat has pushed energy demand to record highs. As the climate changes, these stresses will mount.
The United Nations Environment Programme warned this month that if drought conditions persist, the two largest hydroelectric reservoirs in the US — Lake Mead and Lake Powell —could eventually reach "dead pool status," where water levels fall too low

to flow downstream. Lake Mead fuels the Hoover Dam, which has a power capacity topping 2,000 megawatts while Lake Powell drives generators that peak at 1,300 megawatts at the Glen Canyon Dam.

"Water supplies for agriculture, fisheries, ecosystems, industry, cities, and energy are no longer stable given anthropogenic climate change," Camille Calimlim Touton, commissioner of the Bureau of Reclamation, told Congress in June.

With hydropower production falling in recent months, natural gas plants are filling the void in the United States, leading to even more greenhouse gas emissions that heat up the planet.

This isn't just a problem in the US. Extreme weather around the world, worsened by climate change, is causing all sorts of stresses to power grids. France has had to curb output from its nuclear power plants because the water they use for cooling warmed up too much. French nuclear plants have also received allowances to discharge hotter water back into rivers to meet energy demand. Low water levels in the Rhine River are threatening to disrupt coal and gasoline shipments in Germany.

As average temperatures continue to rise, many parts of the world will see energy demands grow and supplies constrained, with water as the key factor on both sides of the equation.

The good news is that the energy sector is learning to do more with less water. In the US, the overall water use per unit of energy has been declining in recent years. But that trend will have to accelerate in order to keep people cool and slaked in a warmer world.

How drought is drying up energy production

The energy sector uses water differently than households, farms, and factories, because while it requires a lot, much of that water isn't used up but instead goes back into reservoirs, rivers, and lakes. A dam can release water to spin a turbine to generate electricity and that water can be used again by another dam downstream, for instance.

In the US, 90 percent of electricity comes from thermal power plants. They use a fuel — coal, gas, nuclear — to boil water into steam to spin a turbine that turns a generator. That water is contained in a closed loop. To condense the steam, however, these plants often draw on water sources to cool down. Most US power plants also use a closed loop for cooling, recirculating water with minimal loss, but 36 percent of plants use "once-through" cooling, taking in water from a source and then discharging it back into the lake, river, or ocean it came from.

"The [thermal] power plants may withdraw a lot of water, but they return 98 percent of it, at a higher temperature," said Bridget Scanlon, a senior research scientist at the Bureau of Economic Geology at the University of Texas Austin. "They don't 'consume' a lot."

Coal, gas, and nuclear plants don't necessarily require freshwater, either, and can draw on brackish water or other sources that aren't fit for drinking. That way, they don't have to compete with cities and farms for fresh water.

But drought still affects power generation directly in several ways. For hydroelectric plants, lower water levels in a reservoir means there's less energy available to produce electricity. Reservoirs like Lake Powell, behind the Glen Canyon Dam, store so much water that they can continue providing steady power even through drought years. But the long-term drying across the Western US has managed to drink up these reserves.

"Those are such large reservoirs that it does take multi-year droughts to put a significant dent in hydropower production, but that's starting to happen," said Jordan Kern, an assistant professor of forestry and environmental resources at North Carolina State University. "There is concern, not this summer, but potentially next summer and moving forward, that water levels could be so low that Hoover Dam might not be able to produce electricity."

For thermal plants, droughts mean there is less water overall, including the marginal water sources that they can use. That's compounded during heat waves, where water temperatures rise and lower water levels allow sources to heat up faster. Drawing on hotter water makes power plants operate less efficiently, reducing the amount of electricity they can make. Power plants heat up the water they use for cooling before it's returned to the source. Too much of this hot water pumped back into nature can harm wildlife, which is why the Environmental Protection Agency regulates this "thermal pollution." During heat waves, power plants face limits on how much water they can return to nature, or they must receive special permits to continue operating as normal.

Drought also hampers fuel production for power. Hydraulic fracturing, the technique that provides the most oil and gas in the US, requires enormous quantities of water pumped underground to fracture rock and release fossil fuels. On average, a fracking well uses about 4 million gallons of water. Refining oil also uses a lot of water: it takes 1.5 barrels of water to process 1 barrel of crude oil.

With less water to go around, all of these energy operations become more difficult and expensive.

That said, the Western US so far hasn't seen major power cuts or plant shutdowns like those in Europe this summer. A big reason is that the region is vast, with hundreds of power plants connected through a massive power grid, including more than 600 hydroelectric dams. While many power plants face production shortfalls as a result of the drought, there are enough other generators that can fill the gap, and it's much easier to shunt electricity around the country than water.

"The loss of those projects doesn't mean lights out for ordinary people," said Sean Turner, a water resources modeler at the Pacific Northwest National Laboratory.

And while some basins like the Colorado River are running low, other regions like the Pacific Northwest have had a surfeit of water this year, bolstered by robust snowfall this past winter. That has helped boost hydropower from the region to above-average levels.

"If you take an overall picture of hydro over the whole West, the story is different to

what you would consider if you just look at those isolated cases where drought is really making its impact," Turner said.

Original Article: VOX by Umair Irfan

Pipe dream or possible? Experts weigh in on idea of sending Mississippi River water to West

Two hundred miles north of New Orleans, in the heart of swampy Cajun country, the U.S. Army Corps of Engineers in 1963 cut a rogue arm of the Mississippi River in half with giant levees to keep the main river intact and flowing to the Gulf of Mexico.

The Old River Control Structure, as it was dubbed, is also the linchpin of massive but delicate locks and pulsed flows that feed the largest bottomland hardwood forests and wetlands in the United States, outstripping the better-known Okefenokee Swamp that straddles Georgia and Florida.

Clouds of birds — hundreds of species — live in or travel through Louisiana's rich Atchafalaya forests each year, said National Audubon Society Delta Conservation Director Erik Johnson. They include gawky pink roseate spoonbills, tiny bright yellow warblers, known as swamp candles because of their bright glow in the humid, green woods, and more.

This summer, as seven states and Mexico push to meet a Tuesday deadline to agree on plans to shore up the Colorado River and its shriveling reservoirs, retired engineer Don Siefkes of San Leandro, California, wrote a letter to The Desert Sun with what he said was a solution to the West's water woes: build an aqueduct from the Old River Control Structure to Lake Powell, 1,489 miles west, to refill the Colorado River system with Mississippi River water.

"Citizens of Louisiana and Mississippi south of the Old River Control Structure don't need all that water. All it does is cause flooding and massive tax expenditures to repair and strengthen dikes," wrote Siefkes."New Orleans has a problem with that much water anyway, so let's divert 250,000 gallons/second to Lake Powell, which currently has a shortage of 5.5 trillion gallons. This would take 254 days to fill."

The letter and others with an array of ideas generated huge interest from readers around the country — and debate about whether the concepts are technically feasible, politically possible or environmentally wise. Seeking answers, The Desert Sun consulted water experts, conservation groups and government officials for their assessments.

Engineers said the pipeline idea is technically feasible. But water experts said it would likely take at least 30 years to clear legal hurdles to such a plan. And biologists and environmental attorneys said New Orleans and the Louisiana coast, along with the interior swamplands, need every drop of muddy Mississippi water.

The massive river, with tributaries from Montana to Ohio, is a national artery for shipping goods out to sea. And contrary to Siefkes' claims, experts said, the silty river

flows provide sediment critical to shore up the rapidly disappearing Louisiana coast and barrier islands chewed to bits by hurricanes and sea rise. Scientists estimate a football field's worth of Louisiana coast is lost every 60 to 90 minutes. Major projects to restore the coast and save brown pelicans and other endangered species are now underway, and Mississippi sediment delivery is at the heart of them.

Siphon off a big portion, and “you’d be swapping one ecological catastrophe for another,” said Audubon’s Johnson.

Nonetheless, Siefkes’ trans-basin pipeline proposal went viral, receiving nearly half a million views. It’s one of dozens of letters the paper has received proposing or vehemently opposing schemes to fix the crashing Colorado River system, which provides water to nearly 40 million people and farms in seven western states.

Fueled by Google and other search engines, more than 3.2 million people have read the letters, an unprecedented number for the regional publication's opinion content.

Many saw Siefkes' idea and others like it as sheer theft by a region that needs to fix its own woes.

“Let's be really clear here. As a resident of Wisconsin, a state that borders the (Mississippi) river, let me say: This is never gonna happen,” wrote Margaret Melville of Cedarburg, Wisconsin. “What states in the Southwest have failed to do is curtail growth and agriculture that is, of course, water-driven."

But desert defenders pushed back. John Neely of Palm Desert responded: "All of these river cities who refuse to give us their water can stop snowbirding to the desert to use our water. The snowbirds commonly stay here for at least six months. Do they thank us for using our water? No. Do they pay extra for using our water? No. They’re all such hypocrites. My water, your water. My state, your state. Last time I heard, we are still the United States of America."

Haul icebergs south? Manufacture rain?

Yahoo, Reddit and ceaseless headlines about a 22-year megadrought and killer flash floods, not to mention dead bodies showing up on Lake Mead’s newly exposed shoreline, have galvanized reader interest this summer.

But grand ideas for guaranteeing water for the arid West have been floated for decades. Haul icebergs from the Arctic to a new southern California port. Run a giant hose from the Columbia River along the bottom of the Pacific Ocean to refill Diamond Valley Reservoir. Grab hydrogen and oxygen from the air and make artificial rain.

As zany as the ideas may sound, could any work, and if so, what would be the costs?

Original Article: Dessert Sun by Janet Wilson

South Africa's proposed fracking regulations should do more to protect groundwater

South Africa is extremely water scarce, and water supply will become more challenging in the future. The population and economy are growing, increasing demand. Rainfall is variable and more extreme and prolonged droughts are expected because of climate change. More than 80% of South Africa's available surface water resources are already allocated for use. Groundwater resources will therefore become more important in South Africa.

There is, however, a potential threat to those groundwater resources. South Africa depends heavily on coal for energy but its coal resources are being depleted. The country may turn to unconventional oil and gas resources to augment energy supply. And methods to extract oil and gas can contaminate and deplete groundwater.

Hydraulic fracturing, also known as fracking, is used to extract trapped oil and gas from underground geological formations. A mixture of water, chemicals and sand is injected into these formations under high pressure. This opens up micro-fractures in the rock to release the trapped oil and gas, but it can also disturb the deep geological formations and aquifers. Groundwater can be contaminated if deep saline groundwater migrates to potable groundwater resources via hydraulic connections.

In addition to migration of saline groundwater, the chemicals used during fracking can contaminate groundwater. Wastewater may also get into groundwater via spills and leaks. And the hydraulic fracturing process requires large volumes of water.

Do experts have something to add to public debate?

We think so

Regulations that are properly developed and enforced are therefore vital to protect groundwater resources in South Africa when extracting unconventional oil and gas.

Regulations to protect groundwater

On 7 May 2021, the Department of Water and Sanitation published regulations on the use of water in oil and gas extraction. And on 11 July 2022, the Department of Forestry, Fisheries and the Environment published proposed regulations for the exploration and production of onshore oil and gas for public comment. These regulations aim to protect the environment during oil and gas development.

The environment department also published a document for comment specifying what information must be supplied when applying for a licence to produce oil and gas. The two departments' regulations should be read together since both protect groundwater resources.

Based on a survey of South African groundwater experts that my colleagues and I conducted, I've reviewed the proposed regulations and identified aspects that need attention.

A strength of the regulations is that they list penalties for contraventions, which will help with enforcement. However, there are gaps in the regulations. Some extraction methods and related processes are not regulated.

Original Article: The Conversation by Surina Esterhuyse

Earth sciences researchers locate billion-year-old groundwater in South Africa

An international team of researchers has discovered groundwater that is more than a billion years old deep below Earth's surface – only the second time such a discovery has been made.

The water, which is 1.2 billion years old, was recovered from a gold- and uranium-producing mine in Moab Khotsong, South Africa, confirming that groundwater of such a vintage is more abundant than previously thought.

The find sheds new light on how life is sustained below Earth's surface and how it may thrive on other planets.

"Ten years ago, we discovered billion-year-old groundwater from below the Canadian Shield – this was just the beginning, it seems," says University Professor Barbara Sherwood Lollar of the department of Earth sciences in the University of Toronto's Faculty of Arts & Science and co-author of a study published in Nature Communications. "Now, 2.9 kilometres below the Earth's surface in Moab Khotsong, we have found that the extreme outposts of the world's water cycle are more widespread than once thought."

What's different compared to the 2013 discovery at Kidd Creek Mine near Timmins, Ontario is that high local uranium levels made the find more of a challenge, as the mineral was obscuring the age of the water deep inside the subsurface rock.

Uranium and other radioactive elements naturally occur in the surrounding host rock that contain mineral and ore deposits. Understanding the role of these elements has revealed novel ways of thinking about groundwater's role as a source of energy for rock-eating micro-organisms previously discovered in Earth's deep subsurface. The micro-organisms draw chemical energy from the rock to flourish in the absence of sunlight.

When elements like uranium, thorium and potassium decay in the subsurface, the resulting alpha, beta, and gamma radiation has ripple effects, triggering radiogenic reactions in the surrounding rocks and fluids. The radiation also breaks apart water molecules in a process called radiolysis, producing large concentrations of hydrogen – an essential energy source for subsurface microbial communities that are unable to access energy from the sun for photosynthesis.

In the groundwater samples recovered from Moab Khotsong, the researchers found large amounts of radiogenic helium, neon, argon and xenon, and an unprecedented discovery of an isotope of krypton – a never-before-seen tracer of this powerful reaction history.

While the almost impermeable nature of the rocks where these waters are found means the groundwaters themselves are largely isolated and rarely mix – accounting for their 1.2-billion-year age – diffusion of hydrogen, helium and neon among other gases can still take place.

“Solid materials such as plastic, stainless steel and even solid rock are eventually penetrated by diffusing helium, much like the deflation of a helium-filled balloon,” says Oliver Warr, a research associate in U of T’s department of Earth sciences and lead author of the study. “Our results show that diffusion has provided a way for 75 to 82 per cent of the helium and neon originally produced by the radiogenic reactions to be transported through the overlying crust and captured for industrial applications.”

The researchers stress that the study’s new insights on how much helium diffuses up from deep inside Earth is a critical step forward as global helium reserves run out and the transition to more sustainable resources gains traction.

“For the first time, we have insight into how energy stored deep in Earth’s subsurface can be released and distributed more broadly through its crust over time,” says Warr. “Think of it as a Pandora’s box of helium-and-hydrogen-producing power, one that we can learn how to harness for the benefit of the deep biosphere on a global scale.

“Humans are not the only life-forms relying on the energy resources of Earth’s deep subsurface. Since the radiogenic reactions produce both helium and hydrogen, we can not only learn about helium reservoirs and transport, but we can also calculate the variability of hydrogen energy that can sustain subsurface microbes on a global scale.”

Warr notes that such calculations are vital for understanding how subsurface life is sustained on Earth, and what energy might be available from radiogenic-driven power on other planets and moons in the solar system and beyond – informing upcoming missions to Mars, as well as to Saturn’s moons Titan, Enceladus and Jupitor’s moon Europa. The findings hint at the possibility that subsurface water may persist on long timescales despite surface conditions that no longer provide a habitable zone.

The paper’s other co-authors include C.J. Ballentine from the University of Oxford, researchers from Princeton University and the New Mexico Institute of Mining and Technology. The research was supported by the Natural Sciences and Engineering Research Council of Canada, the Nuclear Waste Management Organization of Canada, the University of Oxford and the Canadian Institute for Advanced Research. The National Science Foundation and the International Continental Scientific Drilling Program funded the drilling and installation of sampling equipment.

Original Article: University of Toronto

Irreversible declines in freshwater storage projected in parts of Asia by 2060

The Tibetan Plateau, known as the "water tower" of Asia, supplies freshwater for nearly two billion people who live downstream. New research led by scientists at Penn State,

Tsinghua University and the University of Texas at Austin projects that climate change, under a scenario of weak climate policy, will cause irreversible declines in freshwater storage in the region, constituting a total collapse of the water supply for central Asia and Afghanistan and a near-total collapse for Northern India, Kashmir and Pakistan by the middle of the century.

"The prognosis is not good," said Michael Mann, distinguished professor of atmospheric science, Penn State. "In a 'business as usual' scenario, where we fail to meaningfully curtail fossil fuel burning in the decades ahead, we can expect a near collapse -- that is, nearly 100% loss -- of water availability to downstream regions of the Tibetan Plateau. I was surprised at just how large the predicted decrease is even under a scenario of modest climate policy."

According to the researchers, despite its importance, the impacts of climate change on past and future terrestrial water storage (TWS) -- which includes all the above- and below-ground water -- in the Tibetan Plateau have largely been underexplored.

"The Tibetan Plateau supplies a substantial portion of the water demand for almost two billion people," said Di Long, associate professor of hydrologic engineering, Tsinghua University. "Terrestrial water storage across this region is crucial in determining water availability, and it is highly sensitive to climate change."

Mann added that a solid benchmark for the TWS changes that have already occurred in the Tibetan Plateau has been lacking. In addition, he said, the absence of reliable future projections of TWS limits any guidance on policymaking, despite the fact that the Tibetan Plateau has long been considered a climate change hotspot.

To fill these knowledge gaps, the team used 'top-down' -- or satellite-based -- and 'bottom-up' -- or ground-based -- measurements of water mass in glaciers, lakes and below-ground sources, combined with machine learning techniques to provide a benchmark of observed TWS changes over the past two decades (2002-2020) and projections over the next four decades (2021-2060).

Mann explained that advances in Gravity Recovery and Climate Experiment (GRACE) satellite missions have provided unprecedented opportunities to quantify TWS changes at large scales. Yet, previous studies have not explored the sensitivity of GRACE solutions using independent, ground-based data sources, leading to a lack of consensus regarding TWS changes in the region.

"Compared to previous studies, establishing consistency between top-down and bottom-up approaches is what gives us confidence in this study that we can accurately measure the declines in TWS that have already occurred in this critical region," he said.

Next, the researchers used a novel neural net-based machine learning technique to relate these observed changes in total water storage to key climate variables, including air temperature, precipitation, humidity, cloud cover and incoming sunlight. Once they 'trained' this artificial neural net model, they were able to look at how projected future changes in climate are likely to impact water storage in this region.

Among their results, which published today (August 15th) in the journal Nature Climate Change, the team found that climate change in recent decades has led to severe depletion in TWS (-15.8 gigatons/year) in certain areas of the Tibetan Plateau and substantial increases in TWS (5.6 gigatons/year) in others, likely due to the competing effects of glacier retreat, degradation of seasonally frozen ground, and lake expansion.

The team's projections for future TWS under a moderate carbon emissions scenario -- specifically, the mid-range SSP2-4.5 emissions scenario -- suggest that the entire Tibetan Plateau could experience a net loss of about 230 gigatons by the mid-21st century (2031-2060) relative to an early 21st century (2002-2030) baseline.

More specifically, excess water loss projections for the Amu Darya basin -- which supplies water to central Asia and Afghanistan -- and the Indus basin -- which supplies water to Northern India, Kashmir and Pakistan -- indicate a decline of 119% and 79% in water-supply capacity, respectively.

"Our study provides insights into hydrologic processes affecting high-mountain freshwater supplies that serve large downstream Asian populations," said Long. "By examining the interactions between climate change and the TWS in the historical period and future by 2060, this study serves as a basis to guide future research and the management by governments and institutions of improved adaptation strategies."

Indeed, Mann added, "Substantial reductions in carbon emissions over the next decade, as the U.S. is now on the verge of achieving thanks to the recent Inflation Reduction Act, can limit the additional warming and associated climate changes behind the predicted collapse of the Tibetan Plateau water towers. But even in a best-case scenario, further losses are likely unavoidable, which will require substantial adaptation to decreasing water resources in this vulnerable, highly populated region of the world."

Mann noted that more alternative water supply sources, including intensified groundwater extraction and water transfer projects, may be necessary to meet the amplified water shortage in the future.

Other Tsinghua University authors on the paper include Xueying Li, Xingdong Li, Fuqiang Tian, Zhangli Sun, and Guangqian Wang. Bridget Scanlon, senior research scientist, University of Texas at Austin, also is an author.

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Original Article: Penn State by Sara LaJeunesse

Eastern Australia faces flood risk this spring, weather bureau warns

Australia faces a 70% chance of La Nina returning this spring, with a high likelihood of wet conditions over the next three months, just after massive floods hit the east coast earlier this year, the country's weather bureau said on Tuesday.

With La Nina, sea surface temperatures in the eastern Pacific Ocean are cooler than normal, waters in the western tropical Pacific are warmer than normal, water moisture in the air picks up and brings rain to eastern and central Australia.

The three-month climate outlook shows a "high chance of above average rainfall for most of the eastern two-thirds of the Australian mainland between September and November 2022," the Bureau of Meteorology said in a climate driver update.

The return of La Nina this spring, which starts in September, comes after devastating floods hit eastern Australia amid relentless heavy rains earlier this year.

"With wet soils, high rivers and full dams, and the outlook for above average rainfall, elevated flood risk remains for eastern Australia," the bureau said.

Original Article: Reuters by Sonali Paul

Study: More systemic risk assessment needed for drought events

To better understand the consequences of extreme climate events in different areas — such as the economy, public health, and food production — researchers from the Department of Geography at the University of Zurich (UZH) analyzed eight extreme heat and drought events in Europe, Australia and Africa occurring during the last 20 years.

Besides examining the direct and indirect consequences for various sectors and systems, they also studied the impact of responses to such events.

“The financial losses, for example, can be substantial,” says Laura Niggli, first author of the study. “In the cases studied they ranged from several hundred million to several billion U.S. dollars.”

In extreme cases such as the 2019/2020 Australian bushfires, losses were up to approximately 100 billion U.S. dollars, which is equivalent to over 5 percent of Australia’s GDP.

Cascade Effects

As the researchers show, the effects of simultaneous heat and drought are not limited to just their individual direct effects on different areas.

“We identified an interconnected web of sectors that interact in direct and indirect ways, which causes additional loss and damage in several other sectors, particularly health, energy, agriculture and food supply,” says Niggli.

It is this multi-layered interconnectedness that makes the risks of extreme events so complex — and critical. The cascading effects spread across numerous sectors and can have far-reaching consequences for essential systems.

“Simultaneous weather extremes are potentially capable of destabilizing entire societally-important systems, such as global trade,” Niggli points out.

The analysis also shows that adaptation measures taken against extreme heat and drought events were mostly reactive and of limited scope. In several cases, the scientists found evidence of misalignment of measures: that is, actions taken by one sector

sometimes had negative effects on other sectors, particularly on the energy and water sectors, the economy, society, culture and ecosystems.

More Systematic Risk Assessment

The researchers make the case that in the future, risk assessment should not just take into account the consequences of extreme events on individual sectors, but should systematically consider the interconnectedness of sectors and systems. This would help to improve the adaptability and resilience of the affected regions.

"This is especially important as in the future we are likely to see unprecedented, combined extreme events with cascading effects exceeding all previous historical cases. These effects need to be carefully analyzed to support the planning of adaptive and reactive measures," says UZH professor of geography Christian Huggel, who led the study.

Original Article: Water World

Thames Water accused of ignoring warnings after hundreds in Surrey endure days without water

Thames Water has been accused of repeatedly ignoring warnings about cuts to supplies and burst pipes in Surrey where hundreds of households had to endure three days without tap water at the height of this weekend's heatwave.

Residents, including some who were vulnerable, had to queue for bottled water on Saturday in temperatures of well over 30C (86F) after a pump failure at Netley Mill treatment works.

By Sunday morning up to 1,000 homes began a third day without water. Supplies were restored to up to 9,000 homes, but many households still complained about low water pressure.

Liz Townsend, a Liberal Democrat county councillor for Cranleigh and Ewhurst, called for Thames Water to be fined over the incident and said the company had failed to respond to numerous complaints about previous cuts in supplies.

"We're completely exasperated," she said. "We had a period last summer when there was just bottled water. We had no water in February during the storm, we had no water in the previous hot period at the beginning of July. And now another hot spell and we have no water.

"Our water infrastructure is not resilient enough to cope with all the new housing and the ageing pipes. Whenever they increase the pressure in the system, we get more and more bursts. I've been having talks with Thames Water for 10 years, and I've been up Westminster several times to raise it, but nobody takes any notice."

Townsend wrote to Sarah Bentley, the chief executive of Thames Water, in July after a previous interruption in supply. The letter, seen by the Guardian, accused the company of taking months, and in some cases years, to repair burst pipes and said it reneged on a public commitment to provide residents with updates on water supplies.

Bentley has yet to respond.

A statement from Thames Water said: “Netley Mill water treatment works is now back in service and supply is gradually being restored to the local network. This will continue over the remainder of the day. We are very sorry that customers have been impacted especially at a time of high temperatures.

“When supplies do begin to return, we are asking customers to try to use this just for essential use initially. This will help us return supplies to everyone quicker. We are supplying bottled water to customers who we know need additional help. If anyone is unable to travel to a bottled water site they should contact us on 0800 316 9800 and we will provide assistance.”

Cranleigh is the latest village to run out of water after an official drought was declared in eight areas of England. Dozens of households in Northend, Oxfordshire have been reliant on just bottled water for the last five days.

Townsend said: “There was no water on Saturday for [between] 8,000 and 9,000 homes. We have got a trickle this morning. But between 500 and 1,000 households are still without water.”

Original Article: The Guardian by Mathew Weaver

India uses more groundwater than US and China combined

INDIA IS THE largest user of groundwater in the world. With an annual extraction of 244.92 billion cubic metres (in 2020), India uses more groundwater than the US and China combined. Today, however, 63 per cent of Indian districts are facing issues related to falling groundwater levels, which also has a direct correlation with poverty rates. It is estimated that poverty rates are 9 to 10 per cent higher in districts where groundwater tables have fallen below 8m.

In the 1960s, India witnessed a boom in groundwater irrigation with the launch of the green revolution. Over 60 per cent of India’s total irrigation is now groundwater-fed. About 85 per cent of rural drinking water supply, too, relies on groundwater sources.

Recognising that the unregulated use of groundwater is draining India dry, the Union government introduced two major initiatives in the last decade. The first one was the National Project on Aquifer Management (NAQUIM) launched in 2012. The principal objectives of NAQUIM are to detect and map aquifers, estimate the groundwater potential and promote groundwater management at the aquifer level. The programme envisaged a paradigm shift from “groundwater development” to “groundwater management”. Eshwer Kale, thematic lead of water resources development and governance at Watershed Organisation Trust (WOTR), however, said aquifer maps generated as part of NAQUIM were unsuitable for making scientific and social interventions at a village level. “This is because these maps are generated at the scale of 1:50,000.”

In 2019, the Union government introduced Atal Jal, another scheme to improve groundwater management through community participation, in seven states. The five-year implementation of the programme—with a total allocation of Rs6,000 crore—started in 2020-2021.

Kale said while projects like NAQUIM were well-intended, the challenge was to demystify the unseen aquifer to the rural population and make them responsible for managing it. Since groundwater is not visible to naked eyes, groundwater resources are often subjected to unscientific extraction and overexploitation. Kale and his team developed a tool called CoDriVE—Visual Integrator, which helps villagers visualise water reserves lying beneath the ground. “The model helps rural populations to do water budgeting,” said Kale. “The precise estimation of groundwater helps farmers grow suitable crops and plan their irrigation schedules.”

Taking traditional knowledge and local topography into account is crucial while implementing groundwater recharging techniques. Laporiya, a remote village located on the edge of the Thar desert in Rajasthan, is a good example. The village, which gets hardly 300mm rainfall annually, has a unique system for recharging groundwater. The village used to experience severe drought till a few decades ago. A group brought together by a school dropout, Laxman Singh, in 1977, to repair a small stone bund, changed the fate of the village. By 1984, the bund became the water source for 1,800 acres.

In 1986, Singh founded an NGO named Gram Vikas Navyuvak Mandal Laporiya (GVNML) and launched a system to recharge groundwater levels. It consists of a series of square pits with mud walls. The small mud walls work as water-harvesting structures. The system slows down the flow of rainwater and gives it enough time to seep into the ground, thereby recharging underground water tables. The excess water gets diverted to nearby ponds.

“Our approach is to consider the original land use pattern and recharge groundwater,” said Jagveer Singh, CEO of GVNML. “When we started working on it, we involved the local community also. We developed this technology in a participatory manner.” He said the model could be replicated in most parts of India, except in hilly areas and places with heavy rainfall. “Our agriculture is flourishing,” he said. “We have sufficient drinking water even when other villages experience drought. We even have surplus water to supply to nearby villages.”

Original Article: The Week by Nirmal Jovial

Total Water in England's Reservoirs Is at Lowest Level Since 1995

The amount of water held in England's reservoirs stood at just 65% of total capacity at the end of last month - the lowest level for that point in the calendar year since 1995.

Most reservoirs are now classed as being "exceptionally low", according to figures from the Environment Agency.

Water levels are lowest at Colliford reservoir in Cornwall, which is only 43% full, Stithians reservoir in Cornwall (44%) and the Derwent Valley reservoirs in Derbyshire (45%).

The Pennines group of reservoirs are at 49% capacity, as is the Wimbleball reservoir in Somerset.

Only four reservoir or reservoir groups are currently recording water levels that are classed as normal: Abberton in Essex (77%); Haweswater & Thirlmere in Cumbria (60%); the Lower Lee group in Hertfordshire and north London (88%); and the Teesdale group in north-east England (72%).

England's total stock of reservoir water has fallen steadily in recent months, from 90% of capacity at the end of April to 85% by the end of May, 78% at the end of June and 65% by the end of last month.

Ardingly reservoir in West Sussex and Hanningfield reservoir in Essex both saw their water level drop by more than a fifth last month - the largest fall recorded by any reservoir or reservoir group.

River levels in July were classed as "exceptionally low" at more than a quarter of sites across England, the Environment Agency added.

These included the Cam in Cambridgeshire (which is now at 36% of its long-term average flow), the Swale in North Yorkshire (32%), the Wye in Gloucestershire (31%), and the Yare in Norfolk (30%).

The level of the Great Ouse at Denver in Norfolk has dropped to just 5% of the long-term average - the lowest July figure for this site since records began in 1970.

Original Article: Bloomberg by Ian Jones, PA

Value of Murray-Darling water rights hits $30 billion

The value of water entitlements in the southern Murray-Darling Basin has surged despite plenty of rain.

The record value of $30 billion in 2021-22, up 13 per cent, was due to heightened long-term interest in water rights and a lack of sellers, research group Aither said in a report on Wednesday.

Aither adviser Erin Smith said wet conditions across the southern basin had increased water supply and reduced irrigation water demand, depressing prices.

“This double whammy saw water allocation prices tumble for the second year in a row,” she said.

Meanwhile the market value of entitlements held by environmental water holders rose to $7.8 billion, up 12 per cent on a year earlier, the report said.

Prices held up in the first half of the water year, but decreased quickly at the end of summer.

Looking ahead, Dr Smith said strong allocations, a favourable rainfall outlook, and very full dams mean low water allocation prices are set to continue in 2022-23.

"The good times for irrigators look set to last at least two years," she said.

Commodity prices, particularly for cotton and rice, are strong, and the trend towards higher-value horticultural production continues, the report found.

About $2 billion worth of water is traded in the basin each year between catchments and along river systems.

But while water trading has become an important business tool for irrigators, it has also been an attractive long-term investment for big climate-savvy funds, including Canada's Public Sector Pension Investment Board.

Across Australia, foreign ownership of water entitlements by investors and business interests is 10.9 per cent.

But the report questions how much higher water entitlement prices can go, given the current low return on investment and with rising interest rates making other markets more attractive.

Federal and state governments remain the largest owners of water in the basin, with a quarter of water entitlements earmarked for the environment as climate change threatens species and wetlands.

Critics say more should be released and entitlements bought back from corporate irrigators or the river system will be irreparably damaged, putting a further squeeze on the highly prized water resource.

Original Article: The New Daily by Marion Rae

Note the attachment is not an inducement to trade and Veles Water does not give advice on investments.