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March 24th 2022

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Welcome to **WATERTALK**

by Joshua Bell

**CLICK THE LINK BELOW**

“A 2 minute technical analysis video of H2O futures”

[https://vimeo.com/691732879](https://vimeo.com/691732879)
The new NQH2O index level of $793.20 was published on the 23rd of March, up $0.14 or 0.02%. The Front Month or April Contract has been trading at a premium ranging from +$73.80 to +$89.94 to the index over the past week. We expect a further convergence of the futures and index prices with the most likely move being from the index upwards to catch the futures.

NQH2O is up 12.29% Year to Date.

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

<table>
<thead>
<tr>
<th>Date</th>
<th>Bid @ Offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 22</td>
<td>863@869</td>
</tr>
<tr>
<td>May 22</td>
<td>909@949</td>
</tr>
<tr>
<td>June 22</td>
<td>930@975</td>
</tr>
<tr>
<td>Sept 22</td>
<td>820@970</td>
</tr>
</tbody>
</table>
The graph above lays out the Nasdaq Veles water index by year, showing 2013-2022. In very dry years, prices clearly rise through the spring, peaking in May to July (with the exception of 2015) as demand for water from farmers peaks. Prices then taper off heading into the winter on reduced demand, and the possibility of rain/snow. The restricted ability to “carry” water, much like one can do with financial contracts, gives this index the same type of seasonal pattern that one sees on some other commodities.

The graph for 2021 is highlighted in red. It shows the same seasonal climb, but at record-high values above each of the last eight years since February. Current bids and offers in the market are still higher than historic prices showing that expectations are that this is an exceptionally dry year and prices may not fall seasonally as much as they have in prior dry years.

(John H Dolan, CME Market Maker)
Over the last week the April daily future volatility high has been 4.80% on March 17th and a low of 0.08% on March 22nd.

For the week ending on the March 23rd the two-month futures volatility is at a premium of 4.25% to the index, up 1.41% from the previous week. The one-month futures volatility is at a premium of 8.72% to the index, up 1.50% from last week. The one-week futures volatility is at a premium of 2.27% to the index, down 0.19% from the previous week. We would expect convergence between the index and futures volatility, the most probable move is for the index volatility to increase. These are large differences in volatility possibly indicating a large underlying price move is imminent.

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 Precipitation Index

Central Valley average is calculated using data from 19 weather stations in the Central Valley, California. Data as of 23/03/2022.

<table>
<thead>
<tr>
<th>STATION</th>
<th>MTD (INCHES)</th>
<th>WEEK ON WEEK CHANGE (INCHES)</th>
<th>% OF 20 YEAR AVERAGE MTD</th>
<th>2022 WYTD VS 2021 WYTD %</th>
<th>2022 WY VS 20 YEAR AVERAGE TO DATE %</th>
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</thead>
<tbody>
<tr>
<td>SAN JOAQUIN 5 STATION (5SI)</td>
<td>1.04</td>
<td>0.39</td>
<td>17.84%</td>
<td>57</td>
<td>69</td>
</tr>
<tr>
<td>TULARE 6 STATION (6SI)</td>
<td>1.04</td>
<td>0.16</td>
<td>26.32%</td>
<td>42</td>
<td>66</td>
</tr>
<tr>
<td>NORTHERN SIERRA 8 STATION (8SI)</td>
<td>1.04</td>
<td>0.48</td>
<td>13.23%</td>
<td>53</td>
<td>79</td>
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<tr>
<td>CENTRAL VALLEY TOTAL</td>
<td>3.12</td>
<td>0.34</td>
<td>19.13%</td>
<td>51</td>
<td>71</td>
</tr>
</tbody>
</table>

RESERVOIR STORAGE

<table>
<thead>
<tr>
<th>RESERVOIR</th>
<th>STORAGE (AF)</th>
<th>% CAPACITY</th>
<th>LAST YEAR % CAPACITY</th>
<th>HISTORIC ANNUAL AVERAGE CAPACITY %</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRINITY LAKE</td>
<td>798,271</td>
<td>33</td>
<td>52</td>
<td>46</td>
</tr>
<tr>
<td>SHASTA LAKE</td>
<td>1,716,789</td>
<td>38</td>
<td>52</td>
<td>49</td>
</tr>
<tr>
<td>LAKE OROVILLE</td>
<td>1,631,365</td>
<td>46</td>
<td>40</td>
<td>68</td>
</tr>
<tr>
<td>SAN LUIS RES</td>
<td>900,507</td>
<td>44</td>
<td>56</td>
<td>52</td>
</tr>
</tbody>
</table>

Reference: California Water Data Exchange
Snow Water Equivalent (SWE) is a commonly used measurement used by hydrologists and water managers to gauge 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.
The US Drought Monitor release their statistics with a 1-week lag to this report. Over the past week the has been 6.25% Class 1 degradation in D2 severe drought conditions and 22.4% Class 1 degradation in D3 extreme 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.
The current satellite picture is showing a frontal system forming in the Northwestern Pacific. This frontal system is expected to bring precipitation all the way down the West coast of the US including Los Angeles, San Diego and the Central Valley. Once it has moved Eastwards it is expected to bring the possibility of some snow to the Sierras. The satellite picture also shows a dry Western and Central US which is still predominated by a high pressure system which will weaken in the West as the frontal system approaches. The Eastern US has a long band of cloud and unstable conditions stretching from Mexico to Halifax in Canada. There is no Monsoonal effect at this time of the year as the current weather systems dominate.

10 Day Outlook

The afternoon update reduced QPF Saturday/Sunday in accordance with latest WPC guidance and the continued dry forecast through the weekend by both deterministic models. High pressure will remain in place on Friday and continue to shift eastward into the weekend as the next system approaches. This system will take the form of a surface/upper low moving in from the northwest on Saturday before drifting southward offshore of central CA by early Sunday. There is still model disagreement on the timing of the arrival of this next system with the GFS the quicker of the two models again in the 12z runs. The 12z run of the ECMWF is now somewhat more in line with the GFS and is no longer showing the low spinning offshore until mid week. The ECMWF now has showers first arriving Sunday night into early Monday morning. This is still about 6-12 hours behind the GFS, and ensembles continue to show a wide range of potential solutions regarding timing and amounts of precipitation. Therefore, high amounts of uncertainty remain in the forecast.
WESTERN WEATHER DISCUSSION

Following a very wet December 2021 (in some cases a record wet December) for many areas in the West, a very dry pattern has persisted since the start of 2022, mainly from southern Oregon southward. Average snow water equivalent (SWE) values have continued to decline across many basins in the West and are now below-normal since the start of the water year (October 1, 2021). Despite, the drying trend leading up to this week across many areas, a stormy pattern brought above-normal precipitation to parts of the Pacific Northwest and Northern Rockies this week, leading to targeted improvements in the central Cascades, northeastern Oregon, and central Montana, where short-term SPEIs and average stream flows are improving, basin SWE values are near 100% of normal, and precipitation is above-normal for the water year. Conversely, farther south in California, widespread deterioration was warranted across parts of the San Joaquin and Sacramento Valleys and the Central Coast. Many of these areas have experienced record dryness since the start of 2022, which has driven some reservoirs to record low levels and resulted in widespread stream flows and soil moisture ranking below the 2nd percentile. Water availability is a real concern as allocation from the Central Valley Project is likely to be either much reduced or non-existent for many farmers in California’s Central Valley, according to the U.S. Bureau of Reclamation.

Reference:
Adam Hartman, NOAA/NWS/NCEP/CPC
Brad Rippey, U.S. Department of Agriculture
‘Historic dry conditions’: California warns of water cuts due to drought’s third year

State regulators gave a bleak drought warning Monday to the farms and cities that draw drinking and irrigation water from California’s major rivers: Prepare for mandatory cutbacks. The State Water Resources Control Board announced it was sending letters to approximately 20,000 water right holders — farmers and cities with historical legal claims to river water. Facing a third straight year of drought, the letter says they should expect to stop pulling water in the coming weeks — and even earlier than last year. It wasn’t until last August that the water board ordered thousands of water users to cut their water use on the Sacramento and San Joaquin river watersheds — arguably the two most important rivers in the state. The fact that the board is warning in March about similar curtailment orders is a sign of the deepening severity of the drought.

“We are experiencing historic dry conditions: February is usually California’s wettest month, but January and February 2022 were the driest we’ve seen in recorded history,” the letter reads. “Statewide, precipitation is less than half the yearly average, and dry conditions are forecast to continue through spring. Last year, extreme drought conditions led to unprecedented actions by the State Water Board that included curtailment of water rights in many California watersheds.” The letter is directed to water rights holders across much of California.

Like last year, the state warned those who pull water from the waterways that feed into the Sacramento-San Joaquin Delta to expect cuts. That affects a massive swath of the state — from Mount Shasta to Modesto to Bakersfield — due to the various tributaries that flow into the Sacramento and San Joaquin rivers. Also receiving letters were those who use water from smaller rivers not connected to the Central Valley: the Russian, Scott, Shasta, Mill Creek and Deer Creek watersheds. ARE MANDATORY URBAN CUTS COMING? Gov. Gavin Newsom has so far resisted ordering mandatory water cutbacks for urban users, relying instead on a 15% voluntary call for conservation. But for the most part, Californians aren’t responding. Officials in his administration have hinted that mandatory cuts could be coming this year. Newsom’s predecessor, Jerry Brown, ordered a 25% cut in urban use during the drought in 2015, a move that had some Californians letting their lawns die and putting buckets in their showers.

Original Article: [The Sacramento Bee by Ryan Sabalow and Dale Kasler](https://www.sacbee.com)
VELES WATER WEEKLY REPORT

Water Service unit to acquire Monterey Water in New Mexico

New Mexico Water Service (New Mexico Water), a subsidiary of California Water Service Group (CWT), has signed an agreement to acquire the assets of Monterey Water Company (Monterey Water), a water utility located in Valencia County, N.M. The acquisition is subject to satisfaction of customary closing conditions and approval by the New Mexico Public Regulation Commission (Commission).

As part of the purchase, New Mexico Water will own and operate the water system, which currently serves 380 residential customers. The Monterey Water service area is less than a half-mile from New Mexico Water’s Rio Del Oro water system and will become part of the Rio Del Oro service area. The acquisition also includes about 100 undeveloped lots that may be served in the future.

“We appreciate Monterey Water’s confidence in our team and look forward to working together and receiving Commission review to complete the acquisition,” said Martin A. Kropelnicki, President and CEO of New Mexico Water. “We also look forward to welcoming Monterey Water customers to our family and providing them the same quality, service, and value that we provide to all of our customers in the Land of Enchantment.”

In addition to the new Monterey Water customers, New Mexico Water currently serves about 16,000 people through 8,500 water and wastewater service connections in its Rio Communities, Rio Del Oro, Meadow Lake, Indian Hills, Squaw Valley, Elephant Butte, Sandia Knolls, Juan Tomas, and Cypress Gardens systems. The utility’s services include meter reading, water quality testing, water and wastewater treatment, water system design and construction, and customer service.

New Mexico Water Service is a wholly owned subsidiary of California Water Service Group, which also includes California Water Service, Hawaii Water Service, Washington Water Service, and Texas Water Service, a utility holding company. Together, these companies provide regulated and non-regulated utility service to more than 2 million people in California, Hawaii, New Mexico, Texas, and Washington. Group’s common stock trades on the New York Stock Exchange under the symbol “CWT.”

Original Article: Seeking Alpha by Jessica Kuruthukulangara

State unveils long-awaited standard for drinking water contaminant

California today proposed a long-awaited standard for a cancer-causing contaminant in drinking water that would require costly treatment in many cities throughout the state. Traces of hexavalent chromium are widely found in the drinking water of millions of Californians, with some of the contamination naturally occurring and some from industries that work with the heavy metal.

The proposed standard is a major step in a decades-long effort to curtail the water contaminant made infamous by the movie Erin Brockovich, based on residents of rural
Hinkley, California who won more than $300 million from Pacific Gas & Electric for contamination of their drinking water.

Once finalized, the standard would be a first in the nation to specifically target hexavalent chromium.

Several hundred drinking water wells throughout the state exceed the State Water Resources Control Board’s proposed standard of 10 parts per billion. The highest levels were reported in parts of Ventura, Los Angeles, Yolo, Merced and Riverside counties. Residents of the low-income, mostly Latino city of Los Banos, for instance, are drinking water that contains three times more than the proposed standard would allow.

Water suppliers say the proposed standard will lead to substantially higher monthly rates for many residents, while public health experts and environmental advocates criticize it as not protective enough of people’s health.

“It’s not terrible, but it’s not acceptable,” Max Costa, professor and chair of environmental medicine at NYU School of Medicine, said of California’s proposal. Costa was an expert witness for residents in the Erin Brockovich case. When it comes to hexavalent chromium in drinking water, he said, “The most acceptable level is none.”

Under the water board’s proposal, 10 parts per billion would be the maximum allowable amount in drinking water. It’s a minute amount, equivalent to about 10 drops of water in an Olympic-sized swimming pool. But it’s also 500 times greater than the amount California’s scientists deem a negligible cancer risk over a lifetime.

Under state law, the state must balance the health risk and the financial cost when setting drinking water standards.

Still not a negligible cancer risk

Today’s proposal is a draft, released to solicit public comment before officially starting the regulatory process, which could begin by late summer. An official drinking water standard is expected to be finalized in early 2024.

Until recently, the science was mixed on whether hexavalent chromium causes cancer when ingested, rather than inhaled. (Inhaling it has been a well-documented cause of lung cancer for workers for several decades.)

But in 2008, National Toxicology Program studies showed rats and mice that drank high doses of hexavalent chromium for two years developed oral and intestinal cancers. In addition, California state scientists who analyzed the scientific literature reported increased stomach cancer risk among people who work with hexavalent chromium.

Chemical industry representatives have criticized the studies, saying the rodents were drinking levels much higher than people are exposed to. Mice and rats are routinely given large doses to extrapolate the cancer risk to a larger human population that lives longer.

In 2011, California scientists set a non-enforceable public health goal for hexavalent chromium that is much more stringent than today’s proposal — 0.02 parts per billion.
VELES WATER WEEKLY REPORT

The amount was chosen because it poses a negligible, one-in-a-million lifetime cancer risk that is generally considered acceptable for environmental contaminants.

The water board’s proposal would pose a much higher risk — one cancer among every 2,000 people over a lifetime, according to the state’s risk assessment.

“I think we would all much prefer to be at a better protective level than one in 2,000 cancer cases,” said Darrin Polhemus, deputy director of the division of drinking water with the State Water Resources Control Board. “But the costs do impose a really high burden at the lower (standard) levels, and just couldn't strike that balance there. So, I wish there was a different scenario to paint.”

Original Article: Cal Matters by Rachel Becker

Only 8 of 20 critical GSA plans approved

Only eight of the 20 California watersheds most critically affected by subsidence have had their groundwater sustainability plans approved by state water officials, according to recent testimony before a state board.

The other 12 – most of which are in the San Joaquin Valley – had their plans marked “incomplete” by state water regulators and face a July deadline to fix their deficiencies, said Paul Gosselin, who oversees the Sustainable Groundwater Management Act office for the state Department of Water Resources.

“One of the overarching things we found is that the basin by and large went to eliminate overdraft, but that doesn’t go to what the act is calling for,” Gosselin told the state Board of Food and Agriculture. The 2014 legislation calls for plans to evaluate “undesirable results” from groundwater overdraft, such as sea water intrusion and land subsidence, he said.

“One had to deal with how lowering groundwater levels affected drinking water,” he said, adding that the districts didn’t explain how its actions would affect groundwater users. “At the end of the sustainable period, there would be a number of wells that would go dry.”

SGMA requires locally led Groundwater Sustainability Agencies (GSAs) to develop groundwater sustainability plans outlining actions and implementation measures to halt overdraft and bring groundwater basins into sustainable conditions. Local agencies identified for implementation have included counties, existing irrigation districts and newly created entities.

High-priority basins had until 2022 to submit plans and are required to reach sustainability by 2042. Those whose plans are marked incomplete were given 180 days to address deficiencies; if they fail to meet a July deadline, the agencies will go into consultation with the State Water Resources Control Board, which could seize control of the basin’s groundwater management activities.
VELES WATER WEEKLY REPORT

The critical plans marked deficient are dotted throughout the San Joaquin Valley, including on the Westside and elsewhere in Kern, Tulare, Kings, Madera and Merced counties.

Original Article: Western Farm Press by Tim Hearden

Exceptionally Dry Conditions Prompt Further Drought Action

After a historically dry January and February, officials are taking further drought action. The California Department of Water Resources (DWR) has reduced allocations for the State Water Project to five 5 percent of requested supplies for 2022. Initial water allocations were for 15 percent after the calendar year began on the heels of a wet December. The statewide Sierra snowpack currently sits at 55 percent of normal, while statewide reservoir levels sit at approximately 70 percent of average.

“While we had hoped for more rain and snow, DWR has been preparing for a third consecutive year of drought since October,” DWR Director Karla Nemeth said in a press release. “We are continuing with a series of actions to balance the needs of endangered species, water supply conservation, and water deliveries for millions of Californians.”

Forecasts are not projecting any significant rainfall coming to the state in the month of March. State and federal officials are advising residents to prepare for a third year of ongoing extreme dry conditions. DWR will be making another assessment for allocations after the next snow survey on April 1. DWR is also taking other drought action with federal partners.

The Bureau of Reclamation and DWR have filed another Temporary Urgency Change Petition with the State Water Resources Control Board. A similar petition had been filed earlier in the water year and subsequently withdrawn after significant rainfall in the month of December. The petition seeks to temporarily modify water rights and usage between April 1 and June 30. More water will be kept in Shasta, Oroville, and Folsom reservoirs instead of being released into the Delta.

“Reclamation and DWR, along with the federal and state fish agencies, have been coordinating throughout the winter to address increasingly challenging hydrologic conditions for environmental flows and water supply,” Reclamation Regional Director Ernest Conant said in a news release. “We all recognize what a difficult year this is going to be for everyone. It’s definitely another roll-up-your-sleeves, all-hands-on-deck water year.”

Original Article: Ag Net West by Brain German/Department of Water Resources CA

Bureau of Reclamation and California Department of Water Resources Seek Temporary Changes to Delta Outflow Requirements to Preserve Water Storage Amid Extreme Drought Conditions

On Friday, the Bureau of Reclamation and California Department of Water Resources jointly filed a Temporary Urgency Change Petition with the State Water Resources
Control Board to temporarily modify requirements in water right permits and licenses for the Central Valley Project and State Water Project between April 1 and June 30. These changes are in response to a historically dry January, February, and first half of March, which are typically our wettest months. Facing a third consecutive year of critically dry conditions, these changes are expected to conserve vital water supplies in upstream reservoirs for critical needs later in the year, including public health and safety, and environmental needs.

After a series of strong December storms, Reclamation and DWR had been hopeful that water from Folsom and Oroville reservoirs would provide for adequate water supply and environmental needs later in the year and a TUCP would not be necessary. However, following the historically dry January and February, Folsom and Oroville are seeing unprecedented declines in inflow forecast. With this decrease in expected inflow, these reservoirs cannot support Delta outflows as expected and there is inadequate storage in other CVP and SWP reservoirs to meet other critical water supply and environmental needs later in the year without a TUCP in place.

“Reclamation and DWR, along with the federal and state fish agencies, have been coordinating throughout the winter to address increasingly challenging hydrologic conditions for environmental flows and water supply,” said Reclamation Regional Director Ernest Conant. “We all recognize what a difficult year this is going to be for everyone. It’s definitely another roll-up-your-sleeves, all-hands-on-deck water year.”

“DWR has been planning for conditions to remain dry since the start of the water year on October 1. We are facing tough but important decisions about how to manage the system for a third year of drought,” said DWR Director Karla Nemeth. “We are taking critical steps like submitting the Temporary Urgency Change Petition in coordination with our federal and state partners, to balance the needs of endangered species, water supply conservation, and water deliveries to Californians.”

As part of the all-hands approach, DWR is also planning to refill the notch in the Emergency Drought Salinity Barrier in the Delta. Work will begin on April 1 to fill in the notch, with completion by April 15. The barrier reduces the amount of saltwater intrusion into the Delta, allowing for reduced flows from upstream reservoirs to conserve water supply. Additionally, based on a recognition by Reclamation and DWR as to the importance of better understanding the source of harmful algal blooms and their impact upon the Delta region, the two are committed to fully participating in multi-agency efforts to address this issue, such as that recognized by the Water Board in response to comments received on the 2021 drought actions.

Additional operational flexibility of the Projects is needed to support priorities, including: providing for minimum health and safety water supplies; preserving upstream storage for release later in the summer to control saltwater intrusion into the Sacramento-San Joaquin Delta; preserving cold water in Shasta Lake and other reservoirs to maintain cool river temperatures for Chinook salmon and steelhead;
Sacramento Valley temperatures may hit 90 way earlier than usual as drought intensifies

In the latest sign that California remains gripped by drought and unseasonably high temperatures, forecasters warned that the Sacramento Valley could see temperatures as high as 90 degrees this week. The National Weather Service said that the high in the northern Sacramento Valley city of Red Bluff could hit 90 degrees Wednesday — at least a month earlier than normal. Historically, the first 90-degree day is in early to mid-May. There’s a 20% to 30% chance that Red Bluff could hit that mark midweek, the National Weather Service’s Sacramento office forecast Sunday on Twitter.

“If Red Bluff hits 90 (degrees) on (Wednesday), it would tie the record for earliest 90 (degrees) day set in 1960,” the weather service said.

The high temperature Wednesday for Sacramento, which is traditionally cooler than Red Bluff, is forecast to hit 86 degrees. After three straight dry winters, California’s Sierra snowpack is well below average, and most of the state’s major reservoirs are in bad shape. On average, these critical sources of California’s drinking and irrigation water are holding 30% less water than usual for this time of year. Gov. Gavin Newsom has so far resisted ordering mandatory water cutbacks for urban users, relying instead on a 15% voluntary call for conservation. But for the most part, Californians aren’t responding. Officials in his administration have hinted that mandatory cuts could be coming this year. Newsom’s predecessor ordered a 25% cut in urban use during the drought in 2015. Last week, the Newsom administration announced it would be cutting water deliveries from the State Water Project, the elaborate network of reservoirs and canals that distributes water all over California.

Original Article: The Sacramento Bee by Ryan Sabalow
allocations, we’re getting a fraction of what we used to receive – lower deliveries than any time in history.

“Unfortunately, so far the level of conservation we’re seeing from the public is not matching the severity of these conditions. We all need to take this drought more seriously and significantly step up our water-saving efforts to help preserve our dropping storage levels and ensure we have the water we need into the summer and fall. Some communities are particularly reliant on SWP supplies, including parts of Ventura, Los Angeles and San Bernardino counties. The residents and businesses in these communities especially need to reduce their water use immediately.

“While Metropolitan and its member agencies are making new supply investments that will help in future droughts, we need greater conservation now to get through these historic conditions.

“We also need the partnership of the state and the federal government to create climate resilient local water supplies and storage to adapt to the changing climate.”

Original Article: Business Wire by Metropolitan Water

Big new California reservoir on track for $2.2B federal loan

A long-delayed plan to build a giant reservoir in Northern California to help withstand the U.S. West’s notorious droughts got a huge financial boost on Thursday when the federal government signaled its intent to loan the project nearly $2.2 billion — about half of the cost to design, plan and build it.

The proposal would flood what’s left of the town of Sites, a tiny community with just a handful of residents nestled in a valley of the coastal range mountains in rural Colusa County. The idea has been around since the 1950s, but there has never been enough money or political will to move it forward.

But now a megadrought caused by climate change that researchers say is the worst in 1,200 years has renewed interest in the project, and efforts to move the project forward are happening quickly. It is also in line to get about $875 million from a voter-approved bond, plus another $450 million loan from the U.S. Department of Agriculture.

And the massive loan announced Thursday by the Environmental Protection Agency essentially preapproved the project and making it close to fully funding the project for the first time. Final approval of the $2.2 billion will take up to two years as federal government and project officials to negotiate the terms and sign documents.

“We’ve definitely turned the corner and we have a nice tailwind at our back,” said Jerry Brown, executive director of the Sites Project Authority overseeing and promoting the project. He is not related to the former California governor with the same name.

The project still must clear some regulatory processes before construction, including an environmental review in which the project is facing fierce resistance. Unlike most reservoirs, the Sites project won’t be connected to a river or stream for water to
VELES WATER WEEKLY REPORT

naturally flow into the lake. Instead, operators will have to pump water from the nearby Sacramento River. Environmental groups, including the Natural Resources Defense Council, have said the project will take too much water from the river, harming endangered salmon. Plus, they say the water from the Sites project will be more expensive for customers because of high pumping costs.

“It’s disappointing that the EPA seems to be prioritizing taxpayer subsidies for this environmentally destructive dam instead of projects for to ensure safe drinking water and wastewaters services,” said Doug Obegi, a senior attorney for Natural Resources Defense Council.

It takes a lot of water to run California, which has nearly 40 million residents. The state has a robust agricultural industry that supplies the bulk of the nation’s fruits, nuts and vegetables and a diverse — but fragile — ecosystem that is home to endangered salmon species.

Original Article: Associated Press by Adam Beam

Oroville Dam evacuees can’t sue as a class, California appeals court rules

Residents who fled from their homes after the Oroville Dam was damaged in 2017 cannot sue as a class, the California Third District Court of Appeals ruled Tuesday. The decision from the Sacramento-based court, which upheld a lower court's ruling, means that plaintiffs suing over the near disaster must each file separate lawsuits.

"The potential viability of the proposed class action appears to depend heavily on the common fact of an evacuation order, but the orders are themselves vague," a three-judge panel of the court wrote in its opinion.

The tallest dam in the U.S., Oroville Dam stands about 77 miles north of Sacramento, where Lake Oroville spills out into the Feather River, and is used for water storage, flood control and hydroelectric power. Heavy rains in the first two months of 2017 sent an unprecedented volume of water through the dam's main spillway, which became damaged. Officials were forced to send water down a crude emergency spillway for the first time in the dam's nearly 50-year history.

A number of counties, including Butte, Sutter and Yuba, told residents to leave their homes, and roughly 188,000 people evacuated. Perhaps miraculously, officials' worst fears went unrealized, and the near-failure of the dam caused limited damage. No one was hurt, and evacuation orders were reduced to "evacuation warnings" after just two nights.

Several plaintiffs sued the state, including the city of Oroville and a number of residents and farmers downstream of the dam. Those individual plaintiffs coalesced into two groups, each seeking to be certified as a class. These were known in proceedings as the Bechtel plaintiffs, who sought to represent all 188,000 people who were forced to evacuate, and Giordano plaintiffs, who sought to represent property owners whose
VELES WATER WEEKLY REPORT

"property values were diminished as a result of the Oroville Dam Crisis and/or the unsafe condition of the Oroville Dam."

In a 90-page ruling, the trial court denied both sets of plaintiffs’ class status. Only the Bechtel plaintiffs appealed. The Bechtel plaintiffs' claims were fairly modest. According to their court brief, they simply sought “to recover out of pocket expenses incurred ... during the two-day mandatory evacuation period and the value of the loss of use of their properties for the two-day mandatory evacuation period.”

The state's Department of Water Resources argued, in filings in the lower court, that the Bechtel plaintiffs couldn't constitute a class because it was impossible to determine exactly why different people had evacuated. While some counties had issued "mandatory" evacuation orders, other jurisdictions only "strongly recommended" evacuation. Even a "mandatory" evacuation wasn't actually mandatory, they argued, since there is no penalty for ignoring the order, and no one comes and forcibly removes you from your home. The state argued that it was impossible to know who had heard what order or recommendation since such messages are typically communicated through the media and not, say, a written letter in the mail.

The lower court wrote, in its decision, "it would be difficult (and in some cases impossible) for many of the putative class members to determine whether they would be eligible to join in the class action. Even the ‘mandatory’ order is not sufficiently detailed to provide enough information to determine if a person actually evacuated, whether an evacuation occurred from a residence, whether that residence was within the ‘zone’ of evacuation and even which order (if any) prompted an evacuation.”

In its own 12-page decision, the three appeals court judges — Jonathan Renner, Elena Duarte and Louis Mauro — agreed.

The Bechtel plaintiffs' attorney and a spokesperson for the Department of Water Resources did not immediately respond to requests for comments.

Original Article: Courthouse News by Hillel Aron

University study shows thousands of jobs could be impacted without proper water allocation

A portion of Central Valley Ag will not receive any water from the Central Valley Project. Now, the Fresno Irrigation District is waiting until early April to release any water to farmers.

A study done by Pepperdine University shows these allocations, and the lack of Ag water, are going to be devastating for not just farmers, but the valley economy as a whole. Three weeks ago, the Central Valley Project allocated zero water for the Westland’s Water District, forcing farmers like Ryan Ferguson to find other ways to water their crops.
“We purchased water last year, but we had to expense over $1 million dollars to purchase this water to ensure water for our permanent plantings,” he said. These plantings are the only crops that Ferguson can afford to water.

“Well, we’re gonna fallow out 40% of our 3,000-acre ranch, so about 1,200 acres won’t have anything planted on them at all,” Ferguson responded.

“Changes in water availability, seriously affect the local economy,” said Pepperdine University and the author of the study, Dr. Michael A. Shires. Dr. Shires has studied the effect water has on jobs in the Central Valley for the past several years and the big picture ramifications.

“I mean, 80% of fresh fruit and produce is grown in California. When you start putting that at risk, it has national implications,” he said.

Shire’s data shows every year water allocation is low, the number of families in Fresno County that fall below the poverty line has gone up.

“We know water equals jobs,” he emphasized. “But what we didn’t really understand is its broader impact. The Westland’s Water District footprint especially has an important impact on economic opportunity in the region.”

This puts an industry that brings in nearly $5 billion dollars in revenue and more than 3,500 jobs to the region, in jeopardy.

Ferguson says farmers are adaptable, but they can only take so much.

“Farmers we’re survivors and we adapt and that’s unfortunately what we’re going to have to do this year to make it through,” he said.

Shire’s data showed that Westland’s growers accounted for more than 40% of all vegetables and melons in Fresno county, and nearly 25% of all fruit and nuts in the county.

Original Article: Your Valley Central by Esteban Reynoso

US WATER NEWS

Lake Powell water crisis is about to be an energy crisis

Stretching for 186 miles along the border of Utah and Arizona, Lake Powell serves as one of two major reservoirs that anchor the Colorado River. Last week, the lake reached a disturbing new milestone: water levels fell to their lowest threshold ever, since the lake was created by the damming of the Colorado in 1963.

The precipitous drop is the result of the decades-long drought in the American West that has ravaged the Colorado River for years, forcing unprecedented water cuts in states like Arizona. This newest milestone on Lake Powell, though, is significant for another reason. The reservoir also sustains a hydroelectric power plant, Glen Canyon Dam, that provides energy to millions of people. That power source, critical for rural and tribal communities across the region, is now in jeopardy.
The federal government expects Lake Powell’s levels to rise again this spring as mountain snow melts across the West, but there’s still a significant chance that the reservoir will reach the so-called “minimum power pool” stage some time in the next few years, at which point it will stop producing hydroelectric power altogether. The dry spell has been causing slowdowns or shutdowns at power plants in California and Nevada, creating yet another challenge for officials trying to adapt to a seemingly endless water shortage.

If reservoirs like Lake Powell keep falling, millions of people across the West will have to turn to dirtier and more expensive energy at a time when transitioning to renewable power is of paramount importance for reducing carbon emissions.

The Colorado provides water for more than 40 million people. While the river has gone through several wet and dry spells over the past century, it’s never faced a challenge like the present “megadrought,” which scientists say has no precedent in the last millennium. As precipitation levels have remained low year after year, inflow from the river’s tributaries has slowed to a trickle, and its reservoirs have started to run dry.

When Lake Powell is full, its surface sits some 3,700 feet above sea level, but the reservoir hasn’t reached that threshold in some time. Water levels have fallen over the past several years of rainless winters, reaching a new low of 3,525 feet last week. The lake is now only a quarter full, and water levels are just 35 feet above the threshold for power generation. Officials say there is a significant risk the lake will fall below that threshold in the next few winters.

When federal officials built a dam at the southern end of Glen Canyon, forming Lake Powell, they assumed there would always be enough water moving through the Colorado River system to turn the turbines, and thereby generate a supposedly endless supply of cheap renewable energy. The customers who bought this clean power were rural towns, electrical cooperatives, and tribes, many of whom didn’t have many alternate power sources.

In recent years, as Lake Powell has begun to dry up, the turbines have become less efficient. The federal Bureau of Reclamation has already shaved down power deliveries from the dam.

“We are already seeing reduced generation from Glen Canyon Dam,” said Lisa Meiman, a spokesperson for the Western Area Power Administration, a government authority that markets hydroelectric power from around the region. “[Generation] has been dropping pretty consistently as the lake elevations have declined, so we’re about a third less efficient in terms of power production now than we are at an average elevation.”

When that happens, Meiman said, “we have to go out and purchase replacement power in the spot market, which is typically more expensive.” It also comes from dirtier sources like coal and gas, she said. For most customers who buy power from the dam, losing it won’t be all that big of a deal. For them, hydroelectric power accounts for only a fraction
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of their overall power needs, and any price increases get spread out over thousands of users, keeping costs down.

For some customers, though, the shutdown of the dam will be far more painful. Utility bills have already started to rise as the dam becomes less efficient, and a total shutdown would lead to significant cost increases for the small and remote entities that rely on it. Hardest hit will be the 50-odd tribal nations dependent on hydroelectric power not only for residential energy needs but also to power revenue-generating commercial ventures like casinos. Thanks to generations of underinvestment by the federal government, many tribes that buy electricity from Lake Powell don’t have their own power generation capacity to replace it, and building new power sources isn’t cheap. According to a report produced by a consulting firm looking at the impact of a Glen Canyon Dam shutdown, tribal nations would experience the “the most troubling” consequences of the power loss.

The dam’s largest tribal customer is the Navajo Tribal Utility Authority, or NTUA, which provides electricity to some 30,000 residential customers on the Navajo reservation. “It’s a very sensitive issue for all of us right now,” Walter Haase, the tribal utility’s general manager, told the Associated Press last week on the heels of the water level announcement from the Bureau of Reclamation.

Original Article: Grist by Jake Bittle

How a change in Utah water law will help Great Salt Lake

At last.” Those were the two words Lynn de Freitas, executive director of FRIENDS of Great Salt Lake, led with when asked about a bill headed to the governor’s desk that would give natural lands, like the Great Salt Lake, access to water rights. As Utah law now stands, sovereign lands aren’t able to hold rights to water because there isn’t an entity allowed to manage them. When water law was first crafted, Great Salt Lake “wasn’t considered a beneficial use,” de Freitas explained. “At the time that the water law was established, the lake wasn’t at the table,” said de Freitas. “It was primarily ranchers and farmers, landowners and industries.” HB33, sponsored by Rep. Joel Ferry, R-Brigham City, would expand the definition of beneficial use and who is able to apply for and hold an in-stream water right. If the governor signs HB33, the Utah Division of Forestry, Fire and State Lands would be granted the opportunity to buy water leases and water rights (when and if they become available) to bring water to the Great Salt Lake and keep it there. And the FFSL wouldn’t be the only entity allowed to look after in-stream flow rights in the state. HB33 expands the market of water rights and in-stream flow holders to basically anyone, as long as they meet the criteria. Previous water laws didn’t allow any appropriated water to stay in streams until about 14 years ago when Utah lawmakers passed a statute that let the Division of Wildlife Resources (DWR) and Division of State Parks keep water flowing downstream to protect
a small number of fisheries. In this instance, farmers were allowed to lease their water to maintain the fish population of two species, but it was rarely used. Ferry stood in front of the Utah House last month and confidently told his colleagues HB33 would be the “one of the most significant pieces of water legislation that we will see during our time here at the Capitol.” And lawmakers seem to notice the importance of the bill, considering it received two “nay” votes in the House and passed the Senate unanimously. Rep. Steven Lund, R-Manti, and Rep. Merrill Nelson, R-Granstville, who both voted against the bill, did not return requests for comment.

Beneficial changes to beneficial use
Emily Lewis, a Utah water lawyer and adjunct professor at the University of Utah’s law school, wholeheartedly agrees with Ferry’s statement, calling HB33 “a very positive change of the law.” The biggest change this bill provides is altering the “use it or lose it” stipulation for water rights holders. Under current water law, those who own a right or a share are forced to use the entirety of the water allocated to them annually or they’re at risk of losing the water to the state.

However, HB33 provides water owners a third option: Lease the water that’s not being used instead of wasting it or forfeiting it to the state, creating an “innovative way that we allow water right holders to have additional options to use their water,” Ferry said. Ferry explained the bill using a wheat farmer as an example. If a wheat farmer knows it’s going to be a dry year, it may be a financial loss to attempt to harvest the crop. Instead, the farmer could lease the water he would have used to grow wheat to the Great Salt Lake, or another buyer, for up to 10 years. That way the farmer maintains autonomy can decide to keep water in-stream without the risk of losing the right and making some money.

“At its core, we, as farmers and ranchers, are businessmen and our water rights are an asset,” Ferry, who is a full-time farmer, told the House. “We want to make smart decisions with our water. This allows me to have a more diversified portfolio to where I can utilize my water to its highest and best use, as I decide.”

The incentive to lease the unused water is a plus in the eyes of Laura Vernon, the Great Salt Lake coordinator for FFSL. “Our upstream users shouldn’t be penalized if they don’t use their water,” Vernon stated. “Rather, there should be an incentive for them to let that water go down to the lake.”

How to secure water
It’s not easy to obtain rights to Utah’s most important dwindling resource. Utah lawmakers allocated $40 million to a Great Salt Lake trust during the 2022 legislative session. The trust will be managed by various stakeholders with the purpose
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of bringing water to the Great Salt Lake, including the purchase of water leases and rights to keep water flowing in-stream to help fill the lake. Water rights are often expensive and go through an extensive application process. Since the bill works under the current water appropriations structure, in-stream flow applications are to obtain existing water rights, not new ones, since the pool of new water rights is essentially nonexistent, Lewis says.
The real work begins once an in-stream flow application is filed. Before an in-stream flow application can be approved, it has to pass a series of tests. Lewis, the water lawyer, says the in-stream flow-change application must tie back to three beneficial use conditions:
   1. The propagation or maintenance of wildlife management.
   3. The reasonable preservation or enhancement of the natural aquatic environment.
The in-stream flow applicant will then have to go through a public hearing where people can object to the change application, the state engineer will identify if the application change harms existing water right holders, and the application must be given the ultimate green light by the state engineer in consultation with either DSP, DWR or FFSL. Altogether, Lewis says, it takes about three to four months for an application to be approved, but a change application for in-stream flows depends “pretty heavily on knowing what the conditions are in that particular stream reach.”
Lewis expects to see change applications sliding across her desk the moment the bill is signed.
“Now that some of the more restrictive elements have been removed,” she said, “I think you’ll see a lot of people try and apply for these change applications to either shore up existing agreements that have been harder to find a basis for or promote new activity.”
Original Article: KSL News Radio by Saige Miller, The Salt Lake Tribune

Troubled Kentucky water district wins funding for upgrades
A troubled Kentucky water district has been given more than $400,000 from the state for improvements and upgrades. Gov. Andy Beshear announced the funding Friday, calling it “another important milestone.”
The funding through the Better Kentucky Plan’s Cleaner Water Program totals $411,148. The district’s raw water intake and water treatment plant are in bad shape, Beshear’s office said. They need upgrades for worker safety and to prevent environmental damage, the governor’s office said in a news release.
The project will replace main lines, service lines, meters, valves and hydrants where there has been a continued source of leaks and breaks, the release said. An access road at the raw water intake site will be paved and the roof over a chemical storage area will
GLOBAL WATER NEWS

Groundwater: depleting reserves must be protected around the world

Though water is central to our everyday lives and indeed life itself, we often mark World Water Day on March 22 not by reminding ourselves of all that water brings, but of the consequences of its absence or contamination.

As the American polymath Benjamin Franklin noted, “when the well runs dry, we (shall) know the worth of water”. This direct reference to groundwater, the water flowing through the pores and cracks in rocks beneath our feet, is fitting as the theme of this year’s water day is Groundwater: Making the Invisible, Visible.

Groundwater is our planet’s invaluable natural store of freshwater but it is woefully neglected. It differs from the water running off into rivers, lakes and wetlands as this underground flow derives from precipitation that occurred years, decades or even millennia ago. Much of the estimated 23 million km³ of groundwater in the upper 2 km of the Earth’s crust is ancient. Yet even the shallower and more easily accessible water, part which has been replenished by rain over the past half century, still greatly exceeds all other unfrozen water on Earth.

Found throughout landscapes on all continents, groundwater plays a vital role in not only sustaining water-dependent ecosystems during periods of low or absent rainfall, but also providing people with access to safe water, especially off-grid communities. In drylands that stretch across around 40% of the world, groundwater is often the only perennial source of freshwater. It is estimated that half of the world’s drinking water and a quarter of all the water used in irrigation are currently sourced by groundwater drawn from wells and springs.

Groundwater flowing within rocks underground known as aquifers is generally more resilient to climate variability and change than surface waters. Therefore droughts – whose frequency and severity are amplified by global warming – often increase dependence upon groundwater. This was recently witnessed in Cape Town in South Africa, which narrowly avoided “day zero” when the municipal water supply would be turned off. It has even been argued that human evolution itself relied on continuous spring discharges during periods of extreme drought.

The world is expected to become more dependent upon fresh water stored as groundwater as societies adapt to a world in which rain falls less frequently but in heavier bursts brought about by climate change. Recent evidence suggests such changes
in rainfall may favour groundwater replenishment in the tropics to cope with drier periods, and that irrigation with groundwater could address climate change threats to rain-fed agriculture.

Original Article: The Conversation by Richard Taylor and Mohammad Shamsuddiha

Europe’s groundwater — a key resource under pressure

Many ecosystems and economic sectors in Europe depend on the availability of water of sufficient quality. Groundwater provides a safe and sustainable resource to meet demands for drinking, agriculture, industry and tourism. In particular, meeting water demands for drinking and agriculture depends significantly upon groundwater, which accounts for 65% of drinking water and 25% of water for agricultural irrigation. But groundwater is a finite resource that needs to be protected from pollution and over-exploitation, to ensure the long-term sustainability of its use for human activities and natural ecosystems. Groundwater is an integral part of the natural water cycle. Once degraded or depleted, it can take years or decades for groundwater to recover.

In the EU, the Water Framework Directive (EC 2000) requires the management of groundwater bodies with the aim of achieving good chemical and quantitative status. Reporting under the Water Framework Directive in the second River basin management plan (RBMP) reporting cycle (2016)[1] indicates that 24% of the total groundwater body area in the EU-27 is of poor chemical status and 9% is of poor quantitative status. Combining both chemical and quantitative status assessments shows that 29% of the total groundwater body area lacks sufficient capacity to meet the needs of ecosystems or society, owing to deterioration of either quality or quantity[2]. Reporting under the second RBMPs largely attributes the failure to have achieved good chemical status to diffuse pollution from agriculture and the failure to have achieved good quantitative status to water abstraction for irrigation.

Agriculture puts groundwater under increasing pressure

Agriculture plays an important role in providing food security and makes the EU a global leader in agri-food exports, which amounted to EUR 138 billion in 2018. The total value of this economic sector within the EU was around EUR 405 billion in 2018. Since the Second World War, Europe’s agricultural output has grown considerably, delivering a great diversity of food at affordable prices. However, this has resulted in a deterioration of the quality and quantity of groundwater resources, driven by the increased use of nutrients, chemical pesticides and crop irrigation. These pressures in turn have affected groundwater-dependent aquatic environments and ecosystems, and are being further exacerbated by climate change.

Diffuse pollution from agriculture is the most common pressure causing less-than-good groundwater chemical status, and affects 19% of the total groundwater body area in the EU-27. The most common pollutants reported to have caused failure to achieve good status are nitrates, then pesticides — this reflects reporting requirements under the
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Water Framework Directive, which stipulates that Member States must report on these categories of pollutants, while reporting on other pollutants is more country dependent.

Groundwater pollution from agriculture is widespread in central and southern Europe (Map 1). Once groundwater becomes polluted, it can take decades to recover: nitrate concentrations in European groundwater have shown little change over almost 30 years. Nitrogen surpluses in agricultural soils, which provide an ongoing source of nitrate to groundwater, are still identified in Czechia, Denmark, Germany, Hungary, Ireland, Italy, the Netherlands, Spain and in large parts of France. Pesticides were found to exceed legal limits at between 3% and 7% of groundwater monitoring sites between 2013 and 2019.

Water abstraction for irrigation and other agricultural activities causes less-than-good groundwater status in almost 7% of the total groundwater body area of the EU-27. Abstraction pressures are mainly found in Greece, France, Hungary, southern Italy and Spain.

The 27 EU Member States abstracted around 38 billion m3 of groundwater each year between 2010 and 2019, accounting for 65% of total water abstraction for public water supply. A supply of high-quality and sufficient volumes of water to the public is essential for domestic uses such as drinking, food preparation and hygiene.

The pollution of groundwater leads to significant costs for drinking water utility companies. Costs arise from denitrifying water, removing pesticides and blending with cleaner water. Over-abstraction of water from coastal freshwater aquifers may also result in saline intrusion into the underlying seawater. This can make the groundwater unusable for decades and can increase the cost of treatment. At particular risk are the karstic aquifers of the Mediterranean coast, which are extensive in Croatia, Greece, France, Italy, Malta and Spain. These aquifers tend to be under intense pressure from agriculture and drinking water abstraction, due to population growth and tourism.

Urbanisation, industry and mining exacerbate pressures on groundwater

Aquifers situated beneath urban and industrial areas can represent a strategic resource for potable water. However, point and diffuse source emissions of contaminants from urban and industrial areas can significantly impact on the quality of groundwater and, hence, its suitability for human consumption. Chemicals that pose risks to groundwater quality in urban and industrial areas typically include nutrients, metals, hydrocarbons and chlorinated solvents (EEA 2018).

About 5% of the groundwater body area in the EU-27 in 2016 was reported to be of less-than-good chemical status as a result of point source and diffuse source pollution from abandoned industrial or contaminated sites (EEA 2020).

Areas in which significant industrial pressures cause less-than-good groundwater status are mainly found in certain EU Member States and regions, including Belgium, Bulgaria,
Czechia, northern Estonia, northern France, northern Germany, Hungary, many parts of Italy and southern Spain (Psomas, Bariamis, Rouillard, et al., 2021). Pressures from mining activities are less widespread than industrial pressures at the EU-27 level. However, they are particularly significant for certain EU Member States and regions. Almost 3% of the total groundwater body area of the EU-27 is of less-than-good status and is affected by diffuse source pollution from mining (EEA 2020). Large parts of Bulgaria, northern Estonia, northern Germany, Western Macedonia in Greece, western Hungary, central and southern Poland, western Slovakia, and parts of Catalonia and Andalusia (e.g. Rio Tinto) in Spain are among those regions where diffuse pollution from mining was reported to be the main pressure causing less-than-good chemical status in groundwater bodies (Psomas, Bariamis, Roy, et al., 2021).

Climate change effects
Climate change may affect groundwater quality, through interdependencies between pollution and over-abstraction. For example, if an aquifer is over-abstracted, the concentrations of nutrients and chemicals may increase, because pollutants will be less diluted. Over-abstraction in water-stressed areas can also cause groundwater pollution if saline or polluted waters are drawn into the aquifer (Cantor, et al., 2018). The rise in average sea level and the increase in storm surges predicted as a result of climate change may lead to coastal groundwater aquifers across the EU-27 being further affected by seawater intrusion (Psomas, Bariamis, Roy, et al., 2021).

Climate change is expected to increase the demand for water for irrigation in Europe (EEA 2021). For example, increasing temperature may allow the expansion of agricultural activities in northern latitudes and, in turn, increase demand for water for irrigation in this region. The integrated management of water demand at river basin level is essential to prevent unsustainable over-abstraction in areas where water stress prevails.

Water stress already affects 20% of the European territory and 30% of the European population on average every year (Map 2), while droughts cause economic damages of up to EUR 9 billion annually and additional, unquantified damage to ecosystems and their services (EEA 2021).

[1] Reporting for Member States’ third river basin management plans will be finalised in March 2022.
[2] According to the convention of combined assessment, good status is indicated by an assessment of good for both chemical and quantitative status in a groundwater body. Poor or unknown status for either chemical or quantitative status is regarded as poor overall.

Physicists Just Discovered a Weird New Tetragonal Phase of Water Ice

A new crystalline form of water ice has been discovered in fleeting transitions between phases at high pressures. It’s called Ice-VIIlt, and it takes place as the substance slides between two already known, cubic arrangements of molecules. Although it’s unlikely Ice-VIIlt would naturally appear on Earth’s surface, it could reveal more about how water behaves on massive alien worlds.

We might think it commonplace, but water is actually pretty weird compared to other liquids we know. The arrangement of molecules within water’s frozen form – ice – can vary significantly, depending on the conditions around it.

We know of at least 19 of these solid phases of ice, some of which occur naturally, some of which have only been seen in laboratory conditions. The ice you see in the freezer, or falling from the sky as snowflakes or hailstones, is the most common natural ice on Earth. It is called Ice-I, with oxygen atoms arranged in a hexagonal grid. The structure is, however, geometrically frustrated, with the hydrogen atoms hanging about in a disorderly fashion.

When physicists cool Ice-I at various temperatures and apply different pressures to it, the hydrogen and oxygen atoms within can periodically reach different arrangements, sometimes even ordering themselves more neatly. These various forms of water ice are not always stable, but we can explore these in the lab to reveal their curious molecular structures.

Two of these phases that have cubic structures are Ice-VII, which has disordered hydrogen, and Ice-X, which is symmetric. These can be reached by subjecting ice to high pressures tens to hundreds of thousands greater than Earth’s atmospheric pressure at sea level, Ice-VII at even lower pressures than Ice-X.

To study the transitions between ice phases, a team of physicists led by Zach Grande of the University of Nevada, Las Vegas performed experiments on high pressure ice using a new technique to measure the properties of the ice as pressure was applied. The researchers squeezed a sample of water in a diamond anvil, forcing it to freeze in a jumble of crystals. Lasers were used to then heat the sample, causing it to melt before re-freezing into what the researchers described as a powder-like collection of crystals.

By incrementally raising the pressure in the anvil, with periodic blasts from the laser, the researchers created Ice-VII, and observed the transition to Ice-X. In between, thanks to their new measurement technique, they also observed the new intermediate phase, Ice-VIIlt.
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In this phase, the cubic lattice of Ice-VII is stretched along one of its vectors so that the structure extends into a rectangular arrangement, with a cubic footprint, before settling into the symmetric, fully ordered cubic arrangement of Ice-X. This arrangement is known as tetragonal.

The team also showed that Ice-X can form at much lower pressures than previously thought. Ice-VII forms from approximately 3 gigapascals; that is, 30,000 atmospheric pressures. According to the team’s observations, the transition to Ice-VII occurs at around 5.1 gigapascals.

Original Article: Science Alter by Michelle Starr

Water level dips in Chennai reservoirs

Storage levels in key reservoirs supplying water to the city have dipped when compared to last year’s levels.

Last year, during the corresponding period the storage stood at 9,295 million cubic feet (mcft) vis-a-vis 8,746 mcft on Sunday.

PWD officials said the ongoing heat wave coupled with a reduced flow of Krishna water from Andhra Pradesh have led to the dip.

A senior official said during March last year, there was copious inflow into the reservoirs because catchment areas of reservoirs received ample rain during 2020 monsoon. This apart, there was ample inflow from the Krishna river too.

This year, PWD authorities from the state had requested their Andhra Pradesh counterparts to stop the release of Krishna water since December last year. This was due to two reasons. Firstly, the reservoirs were brimming with water in January. If the water from AP continued to flow, then the surplus from the Poondi reservoir would have to be released to Red Hills, which was filled to the brim. Secondly, the PWD authorities have begun repair work in the canal that brings Krishna water from the Zero point in Oothukkottai to Poondi reservoir, the official explained.

Last year in March, Poondi reservoir had 2,387 mcft of water, and now it has 2,072 mcft; Cholavaram had 795 mcft and now it has 770 mcft; Red Hills had 3,052 mcft, and has 2,894 mcft currently. Chembarambakkam reservoir had 3,062 mcft, and has 3,010 mcft currently.

The new reservoir Kannankottai Thervoykandigai had 499 mcft last year, but has 500 mcft currently, which is its full capacity.

An official said the current storage levels at the reservoirs can help quest the city’s thirst for the next nine months without any difficulty.

Original Article: Times of India by P Oppili
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Water security a 'challenge' for Central West, says Infrastructure Australia report

Water security is at the "forefront of challenges" for the Central West, according to Infrastructure Australia's new Regional Strengths and Infrastructure Gaps report. Without increased capacity, it's estimated that the region would lose "a loss in economic uplift of $167 million on average per year", the report states.

As the Central West receives a lower volume and more fragmented rainfall than other regions in Australia, the baseline risk for farmers in the region is significantly higher," the report states.

"As new industries emerge, water is increasingly being used for mining, lifestyle and urban development, driving competition for water throughout the Central West. "The combined impacts of climate change and variability, as well as water regulation, have the potential to dislocate existing infrastructure, communities and sectors." Lachlan Valley Water chair Tom Green says the concerns highlight the need to raise the Wyangala Dam wall.

Mr Green says the latest report backs up concerns that climate change is having a detrimental impact on the valley - and this is not just about water security but also flood management capability as seen last November when flooding wiped out crops right on harvest.

"It's now time for action by both state and federal governments, and bipartisan support should be provided to increase Wyangala Dam's capacity," Mr Green said.

"The study highlights what we have been seeing and going through for many years. "A larger dam will protect the whole community in the Lachlan Valley as climate change continues to have a greater impact on the valley and its communities. "Let's see some real leadership from government with this project and here is some substantive data to show the project will pay major dividends to the whole community if constructed and will help provide food security for the whole nation as well as mitigating some of the flood damage across the Lachlan Valley."

Feedback from consultation in the development of Infrastructure Australia's report indicated water security had been a constant and increasing challenge.

"As water availability has become less reliable, the growth of the agricultural industry has been constrained, however the region still produces a significant proportion of New South Wales' agricultural output," the report states.

"Farming practices have had to adopt to become smarter, more resilient and more efficient, and communities have had to effectively manage water usage demand. "It is anticipated by stakeholders that improved water security will be vital to providing business confidence and attracting investment for agriculture, manufacturing and mining."
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Infrastructure Australia says the impacts of drought and water security are expected to continue, and there is a growing need to address the changes in the region and build resilient communities through improved water management. The report highlights existing Australian government commitments to deliver water projects including significant investment in the Central West Industrial Park and Parkes water security project.

The NSW Government is investing in the Wyangala wall raising project as well as water security projects in Orange, Bathurst and Condobolin.

Original Article: Forbes Advocate

Tesla’s German Factory Will Exhaust the Area’s Water Supply

Tesla (NASDAQ:TSLA) Inc. has secured water supply for its factory outside Berlin at the expense of any further development in the area, according to the local water authority. Water reserves for the region are being completely exhausted, Wasserverband Strausberg-Erkner, said in a statement Thursday following a meeting on the Tesla project. WSE said further commercial and industrial development plans aren’t possible without additional extraction permits due to the lack of groundwater extraction.

Concern about Tesla’s plant straining the area’s water supply is one of the main reasons the carmaker will start producing Model Y electric vehicles months later than Chief Executive Officer Elon Musk planned. The economy minister for the state of Brandenburg, where Tesla has constructed the facility, has said that while there was enough water for the first stage of the factory, more will be needed as Tesla expands. Tesla secured approval for the project early this month and said it expected to obtain an operating license within a matter of weeks. The company has sent out invitations to a delivery day event at the factory on March 22.

Original Article: Bloomberg/ Investing.com
Note the attachment is not an inducement to trade and Veles Water does not give advice on investments.