

## **Distrust of satellite monitoring delays Madera County's plan to penalize growers for over pumping**

Sjvwater.org, 09/23/22

Fear and confusion over a new groundwater monitoring technology pushed back the “penalty phase” of Madera County’s attempt to get a handle on its pumping problem.

The Madera County Board of Supervisors was supposed to have voted on penalties for growers who pump more than they’re allowed at its Sept. 13 meeting. But after three hours of debate and hearing from more than 15 members of the ag community about whether the county’s new water monitoring system – Irrivatch – is working properly, supervisors pushed the decision off to Sept. 27.

The meeting was tense with Supervisor David Rogers even calling Irrivatch “junk,” despite multiple verification efforts from universities that have shown the technology is largely accurate.

County staff must now bring revised penalty options to the Sept. 27 meeting even as Irrivatch technology is still going through testing in Madera.

The stakes are considerable as Madera County must reduce excessive pumping in areas it covers that are outside of irrigation districts, meaning they have little to no surface water to water crops and rely almost exclusively on groundwater.

The Madera County Groundwater Sustainability Agency (GSA) had given growers strict pumping allotments already. Penalties for going over those allotments were supposed to be decided at the Sept.13 meeting.

Now Stephanie Anagnoson, director of water and natural resources for Madera County, must present three revised penalty options.

“Without penalties, there is no incentive to stay within your allocation. And to me that says we’re not compliant with what we’ve agreed to do,” said Anagnoson. “Now, maybe you don’t need a big penalty to do that. Maybe you need a smaller penalty. But I do think that demand reduction through allocations or water budgets that decrease over time was a key part of how we get to sustainability. So, I think it’s pretty important.”

In response to the Irrivatch monitoring skepticism, the county is undergoing a “verification project,” testing Irrivatch and gathering a wealth of data to settle the matter.

Irrivatch is one of many methods agencies throughout the state are using to monitor groundwater use and comply with the Sustainable Groundwater Management Act (SGMA.) The law aims to bring over pumped aquifers to sustainable levels by 2040.

To get there, GSAs need to know how much groundwater is being used. Well meters in the county were considered impractical for the Madera County GSA as not all farmers have well meters and it would take time to install and properly calibrate them throughout the GSA.

The GSA worked with the Madera County Farm Bureau and the Madera Ag Water Association, an organization formed by local growers, to review different monitoring methods, said Anagnoson. A panel of growers selected the option of Irr WATCH partnered with engineering consultant, Davids Engineering.

Irr WATCH uses satellite data to measure the temperature of crops and can compute how much water is used, said Wim Bastiaanssen, CEO of Irr WATCH. Irr WATCH does this through an algorithm which can determine evapotranspiration of plants through satellite imagery. Evapotranspiration is how plants release water.

But as pumping restrictions and penalties neared, some farmers in the Madera County GSA have said Irr WATCH is inaccurate.

Primarily, growers thought Irr WATCH overestimated how much water was being used and that it was inconsistent.

“The entire SGMA implementation system in Madera County is really predicated on some reliable measurement,” said Jack Rice, consultant with the Madera Ag Water Association. “That’s the concern, is people have lost confidence or don’t have confidence in the measurement system.”

But the growers’ claims go against Irr WATCH’s track record.

The technology is widely used to monitor water usage and is highly accurate, said Irr WATCH’s Bastiaanssen. And it has been repeatedly tested and verified, he added.

“I will always say that the butcher should not check his own meat,” said Bastiaanssen. “So, I like to work with universities and other research institutes that carry out those validations so that it’s more independent.”

Irr WATCH’s algorithm has been tested and verified by research partners around the world from South Africa to Israel, said Bastiaanssen.

The Surface Energy Balance Algorithm for Land (SEBAL) is the algorithm developed by Bastiaanssen and used in Irr WATCH. Multiple peer reviewed research papers have demonstrated SEBAL’s effectiveness through studies in Turkey, China and Iran, to name a few.

Last year, the county did a test run of Irr WATCH with farmers who volunteered to use the technology. Some people reported differences between what they saw on their meters and what Irr WATCH was showing.

“It wasn’t really a big group,” said Anagnoson. “But it was enough to make us think as scientists and engineers this was something we wanted to dig in a little bit more on.”

Davids Engineering began a verification project in April. The project includes 17 growers who have given the county and Davids Engineering access to their well meters to compare directly with Irriwatch. There are eight different crop types being monitored across 12,000 acres, mostly permanent crops such as pistachios, almonds and grapes. And the project includes analysis of 90 flow meters.

Since the project began, engineer staff have made weekly visits with every grower involved. They are taking meter measurements, checking irrigation methods and analyzing how meters have been installed, among other tasks.

The project will be completed ahead of the 2023 irrigation season.

One issue that may be confusing growers who see a difference in what Irriwatch is reporting, is meter installation. Unless flow meters are installed to exact specifications, they can be inaccurate.

“For whatever reason, people have a misconception that it’s the meter in and of itself that gets you an accurate reading,” said Anagnoson. “And really, it’s the meter and its installation and ensuring that there is enough laminar flow that gets you accuracy. But I don’t think that’s really well understood.”

Some growers have also pointed out that pistachios have a deeper root structure than other crops and claimed that Irriwatch isn’t correctly computing for pistachios.

Irriwatch’s Bastiaanssen disagreed.

“We look at how much water is used but also we look at the root zone,” said Bastiaanssen. “We take into account the depths of the roots. So, pistachios always root deeper. We made nice corrections for that.”

Bastiaanssen, who is from the Netherlands, isn’t surprised by the distrust. When he started in the remote sensing business 35 years ago, people had a hard time believing a satellite could accurately monitor water, he said. Now, the technology is more widely accepted.

“And yet, this has not reached the bulk of the growers,” said Bastiaanssen. “Without having any experience they just like to say, ‘this is not working.’ But that’s not true.”

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## California should expect a ‘fourth dry year’ as drought persists

Latimes.com, 09/22/22

California’s reservoirs will enter fall in a slightly better position than last year, but the Golden State should prepare for more dryness, extreme weather events and water quality hazards in 2023, officials say.

The latest climate forecasting update from the Department of Water Resources came Wednesday, just days before the end of the water year, which runs from Oct. 1 to Sept. 30 in California. Officials said some of the state’s biggest reservoirs, including Lake Oroville and Lake Shasta, are slightly more full than they were at the same time last year, but still remain well below average.

Water managers are now preparing for a “fourth dry year,” as well as more unpredictable weather and wildfires associated with climate change, DWR Assistant Deputy Director John Yarbrough said during a meeting of the California Water Commission.

“We have more storage in the reservoirs, but we’re still well below average, well below where we’d like to be,” Yarbrough said. What’s more, “we have to prepare and expect that we’re going to see things that we haven’t seen before.”

Part of the challenge facing the state’s water managers is that climate change is making it more difficult to predict and prepare for water outcomes, Yarbrough said. During the 2022 water year, officials observed significant swings between extreme wet and extreme dry conditions, including a notably rainy October through December followed by the driest January through March on record.

Yarbrough said such variability underscores the need for conservative planning and aggressive multiagency action.

“When we look at patterns like this, it really challenges a lot of our practices for how we plan the system, for how we’re going to operate for the next year,” he said.

The 2022 water year also saw warmer-than-normal temperatures and drier-than-normal conditions, he said, but both metrics were slightly improved from the year prior. Lake Shasta, the state’s largest reservoir, is projected to end the water year with 1.48 million acre-feet in storage — up from 1.07 million acre-feet last year.

Still, Yarbrough emphasized that California remains in serious drought. Even with improved storage, Shasta sits at about 34% of its capacity, according to The Times’ drought tracker.

It’s “better than last year but not good enough,” he said.

Though California has experienced periods of drought in the past, Wednesday's report came against a backdrop of significant water cuts and worsening aridity in what researchers have described as the driest 22-year period in at least 1,200 years.

What's more, the state's other primary water supply — the Colorado River — is also running perilously low, with federal officials warning that another 150-foot drop in Lake Mead could lead to "dead pool" conditions, or the point at which water falls below the lowest intake valve on the Hoover Dam.

The looming crisis has put the pressure on California and other nearby states to figure out how to significantly reduce their reliance on the river, and officials have said painful cuts are likely in the coming months.

But climate change isn't only affecting water availability in California — it is also affecting the quality of water, especially in watersheds near wildfires, according to Andrew Schwarz, climate action coordinator with the State Water Project.

More than half of the Feather River Watershed — the largest in the Sierra Nevada — burned in wildfires between 2019 and 2021, Schwarz said. About a quarter of it burned at high intensity levels associated with significant tree mortality.

Such fire activity can have myriad effects on the watershed, including altered soil and vegetation. Schwarz said black carbon deposits from ash and burned trees can change the reflectivity of snow to make it melt faster, while high heat can make soil waxy, more water repellent and more prone to runoff. What's more, erosion and debris flow can send sediment into rivers and other sources of water.

"It's an incredible change in the landscape of a watershed, as you can imagine," he told the California Water Commission.

That confluence of hazards means the state's water managers are increasingly accounting for wildfires in their climate resilience efforts, Schwarz said, including improving water safety plans for local residents and implementing new sensor data to help experts monitor changing hydrology.

"We'll probably have more fire in the watershed, and so we'll be able to continue to adapt to this and get better information as we go along," he said.

Commissioner Alexandre Makler said the reports underscored the need for continued maintenance and asset management on the State Water Project.

"It needs to be in tip-top shape — that's absolutely critical," he said, adding that "it's clear that there is a significant capital component in addressing the risk, and combining that with the planning process."

California has been investing in such work, with the 2022-2023 state budget carving out \$1.2 billion in new funds to lessen wildfire risk through better forest management and \$2.8 billion to support drought resilience and response, among other items.

But the mounting challenges mean there is much work yet to be done. Other water priorities for the coming year include maintaining the quality of the Sacramento-San Joaquin Delta, which is the source of municipal drinking water for many communities, while continuing to meet minimum health and safety needs and protecting species and the environment, Yarbrough told the commission.

It's also critical to conserve as much reservoir water as possible, he said, "so we have water again in case we're faced with a fifth dry year."

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## **Last Week Of September Declared Sacramento-San Joaquin Delta Week**

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State Sen. Bill Dodd, D-Napa, on Wednesday declared the last week of September as Sacramento-San Joaquin Delta Week in recognition of the rivers playing a critical role in the state's economy and environment.

The proclaimed week will kick off Sunday and was established from Senate Concurrent Resolution 119.

Dodd said the Sacramento-San Joaquin Delta Conservancy and Delta Protection Commission have both been vital in protecting the expanse formed by the Sacramento and San Joaquin rivers.

"The Delta is a cherished watershed and the very lifeblood of California's water system," Dodd said. "It is vital to our state as both a natural resource teeming with abundant wildlife and fish and a vital economic driver for tourism, recreation and Delta farmers. We must continue to protect it for future generations by preventing pollution and further marshland degradation and promoting its environmental health."

The Delta is the hub of the state's water supply system and supplies water to over 25 million people, according to Campbell Ingram, executive officer of the Sacramento-San Joaquin Delta Conservancy.

"Those who have experienced the Sacramento-San Joaquin Delta know what a special place it is and the large impact it has on the daily lives of all Californians," Ingram said. "Delta Week showcases the Delta's important role as the heart of California's water system, the home to about 500,000 acres of productive agricultural land, and a world-class recreation and tourism destination."

The rivers also support more than 750 species of plants and wildlife as well as over 55 species of fish, and host more than 12 million visitors a year.

"Sacramento-San Joaquin Delta Week will be an opportunity to highlight the Delta's importance to all Californians," said Bruce Blodgett, executive director of the Delta Protection Commission. "Valuing the needs of the Delta is fundamental to protecting California's economy and environment. The commission looks forward to continuing to work with federal, state, and local agencies to protect, maintain, enhance, and enrich the overall quality of the Delta environment and economy."

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## **Researchers Take New Approach to Quantify Water Use**

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Like many other researchers, environmental engineering professors Erin Hestir and Joshua Viers are trying to quantify water use in California's Central Valley.

The difference is, they are doing it from the sky.

Through NASA's applied sciences program, their team will leverage the power of Earth-orbiting satellites and drones to gather data with high spatial and temporal resolution and then analyze it to help resource managers make better-informed decisions, particularly around water use in California's San Joaquin Valley.

They're collaborating with Point Blue Conservation Science, a nonprofit science team based in the Bay Area.

"Point Blue is a leader in finding nature-based ways to address climate change and biodiversity loss. We're really excited to be partnering with them," Hestir said. "This project will help us better balance water allocation not only for human uses such as agriculture, which are really important, but also to make sure we are sustaining biodiversity and ecosystem functioning critical to the Valley."

Water is a limited resource across the West. Over the past 100 years, an extensive system of reservoirs and water conveyance structures have been engineered to support the needs of human communities, agriculture and ecosystems. Model projections suggest water may become even more limited as the result of climate change, and increasing frequency and severity of drought are pushing water management programs to their limits, the team wrote in their proposal.

"The Central Valley ... is a nexus for water resources and epitomizes the challenges facing water systems in the West," they wrote.

Another critical partner in the project is the Grassland Water District, which seeks to maximize the use of limited water available for ecosystem functioning, as well as waterfowl and shorebird habitat. The district, local to Merced County, manages more than 75,000 acres of wetlands for the Grassland Resource Conservation District.

Effectively quantifying water use is particularly important now that the state's Sustainable Groundwater Management Act has gone into effect. Known as SGMA or Sigma," the act requires all groundwater users to form Groundwater Sustainability Agencies and to come up with Groundwater Sustainability Plans (GSPs) for their specific groundwater basins. These plans will define how groundwater will be managed, and how impacts on drinking water wells and groundwater-dependent ecosystems such as wetlands will be avoided.

Although managed wetlands are an essential component of water use planning and budgeting, there are limited data about the extent and magnitude of managed flooding — often for the purposes of providing habitat for waterfowl and supporting local duck clubs — that can be used to inform water budget models.

Satellites have been able to track the surface water in different wetlands across the Central Valley, but not yet the depth of the water. That's where UC Merced and Point Blue come in. A central component of this NASA-funded project is developing novel algorithms that mine these satellite data to determine the extent, depth and duration of flooded fields and wetlands.

“The ability to generate data on water depth to populate wetland water budgets...will increase the capacity to inform GSPs in a cost-effective way,” General Manager of the Grassland Water District Ric Ortega wrote.

“Rather than assuming there is water in the wetlands because it's been released from the rivers, we're going to try to use new, cutting-edge NASA technology, including space-based sensors as well as drone sensors to create three-dimensional representations of the landscape,” Hestir said. “That will help us understand how much water is truly in the wetlands, which will give people more information when it comes to deciding on how to balance all the different needs.”

The project will also help answer important questions, such as how changes in land management will affect water use and how water use varies across extreme events, particularly drought and flood. This research builds on more than a decade of water research led by UC Merced that is specific to the San Joaquin Valley and its watersheds.

“It is incredibly important that we work with local agencies and water districts to understand their information needs, and that we provide actionable outcomes from our research in return,” said Viers, who leads the Secure Water Future research consortium. “The tools and insights we are developing here will aid in data-driven decision making across the Valley and beyond.”

“A lot of people don't know this, but California is one of 25 hotspots around the globe for biodiversity,” Hestir said. “We have a lot of unique species across the state, and the San Joaquin Valley is a hot spot for our migratory waterfowl, wetlands and surrounding grasslands.”

Resource managers must be careful about water allocation, she said, because it must sustain the robust agriculture economy, a large number of residents and the valuable biodiversity that keeps ecosystems stable.

“In our dry years, every drop counts,” Hestir said.