California Groundwater Awareness Week in 2023

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Monday, March 6 marked the beginning of Groundwater Awareness Week. Now, I know you all are aware of groundwater; how could you *not* be aware, working in agriculture in California? Groundwater does present its own special challenges compared with surface water, for reasons that are evident (it's underground and harder to see) and because humans manage it differently. The Department of Water Resources says:

> *Groundwater and surface water are essentially one resource, physically connected by the hydrologic cycle in which water evaporates, forms clouds, and falls to the ground as rain or snow. Some of this precipitation seeps into the ground and moves slowly into an underground aquifer, eventually becoming groundwater. Water law and water policy often consider groundwater and surface water as separate resources, though they are functionally inter-dependent.*

NRCS to share groundwater information with conservation professionals by bringing you resources and information about specific and intimate entanglements between groundwater and agriculture in California from a conservation viewpoint. There will be more on (explained a little bit further on):

- SGMA, GSAs and GSPs
- Where to find data about groundwater
- Drinking (ground)water, source (ground)water protection, and (ground)water quality
- Farm-based groundwater recharge
- Conservation Planning for Groundwater Resource Concerns

If you're really intrigued by all this, you can watch the California Department of Water Resources' Groundwater Awareness Week Kick-off and Interactive Workshop on YouTube. Explore more Water Basics on Groundwater here!

SGMA, GSAs and GSPs (*So much alphabet soup!!*)

What is SGMA? In 2014, California joined the other Western states in regulating groundwater use by passing the **Sustainable Groundwater Management Act, or SGMA** (say "sigma"). A years-long drought and impacts from over-use of groundwater in many basins prompted the landmark legislation, which is reshaping operating assumptions of the agriculture industry across California.

California is divided up hydrologically into more than 140 groundwater basins, which are like surface watersheds in that they are areas where groundwater collects. They differ from surface watersheds in two ways- their boundaries don't necessarily line up with surface watershed boundaries; and depending on geology you may not have a basin under your feet, especially in mountain areas. SGMA requires that

over-drafted groundwater basins have a plan to reach balance between withdrawal and recharge within 20 years. To do this, local organizations are required to develop **Groundwater Sustainability Plans (GSPs)** and implement them. The new local entities are called **Groundwater Sustainability Agencies (GSAs)**. More than 250 GSAs have been formed in California!

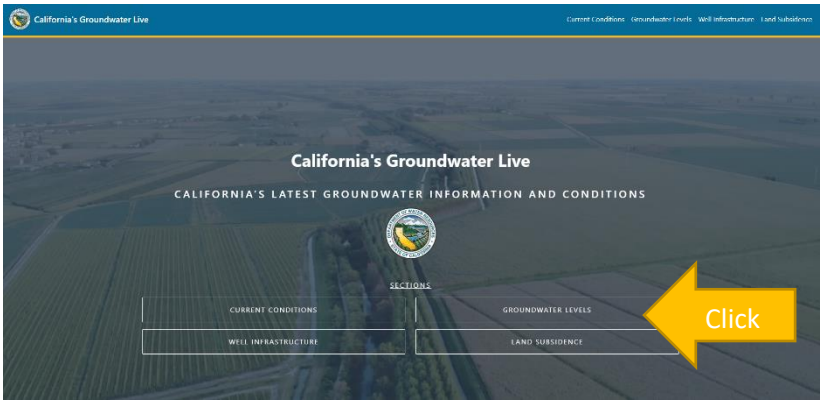
GSAs, a new partner. There are often multiple GSAs in a single groundwater basin, and although they must coordinate GSPs within the basin, they can still have different strategies. This means that producers in an NRCS Service Area may be playing by different groundwater rules than their neighbors. Often the GSAs are led by water or irrigation districts, with representation from cities, counties, Resource Conservation Districts, and agriculture to varying degrees.

GSPs and why you should read yours. Plans for 94 High and Medium Priority over-drafted groundwater basins were due to the Department of Water Resources (DWR) by 2022. The plans must describe the basin's hydrology and historical conditions and detail how the GSA will measure and meet 6 sustainability indicators: reduced groundwater levels, reduced groundwater storage, seawater intrusion, groundwater quality, land subsidence, and depletion of interconnected surface water. Each plan has the flexibility to use strategies that are most effective for their local conditions, subject to approval by DWR. For NRCS, if you're aware of what's in the GSPs for your service area you learn what help growers might need in adapting to SGMA regulations.

The SGMA Portal has maps of GSAs and links to all the submitted GSPs. They are huge map files though, so make sure you're on a good internet connection before you go downloading!

How is MY groundwater?

Now that you're aware of groundwater, you may want more details about groundwater in your area. Lucky for you there are lots of publicly available resources, many of them are online mapping apps you can use to visualize local data. The State of California Department of Water Resources is in charge of groundwater *quantity*, so you can find information about well levels, trends of well levels, and land subsidence on "**California's Groundwater Live**".

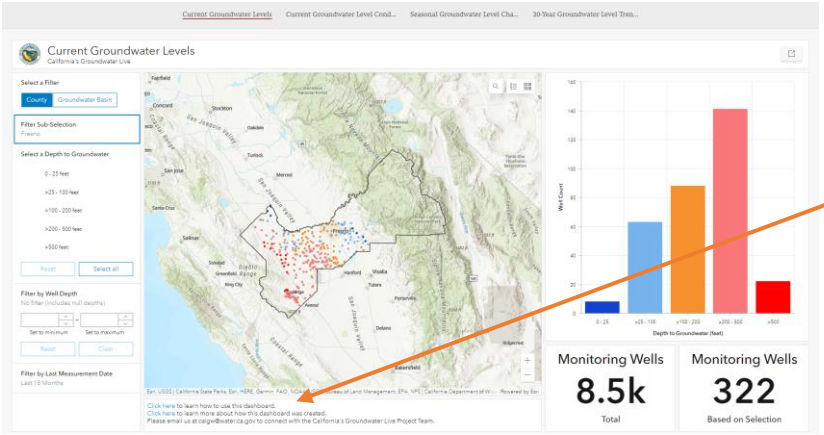


DWR Groundwater Live resources include information on groundwater levels, and land subsidence.

Select the section you're interested in viewing.

Click over to the dashboards for data on current conditions. Choose one you're interested

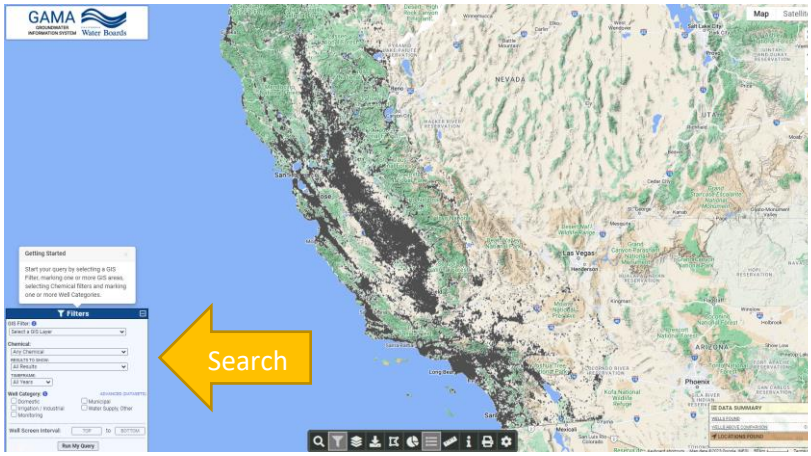
in viewing (or browse through them all!)



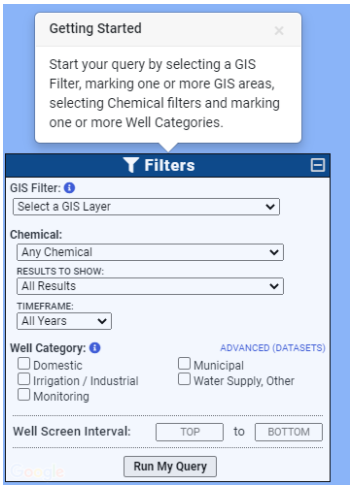
You can filter the dashboard information by county or groundwater basin to zoom into your area on the map.

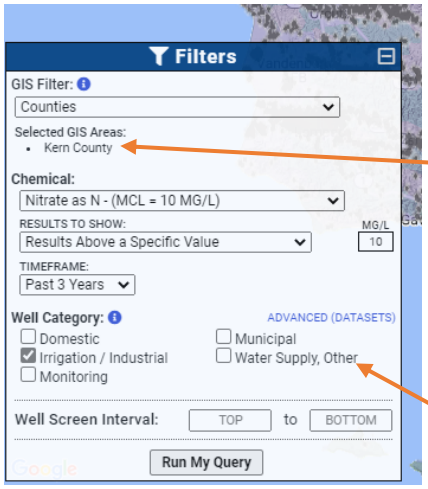
All of the dashboards link to YouTube instructional videos for more help.

The California State Water Resources Control Board is in charge of groundwater *quality*, so there's a different place to look at that data- the **Groundwater Ambient Monitoring and Assessment** program (GAMA).



GAMA Data is available in an online mapping tool as well.

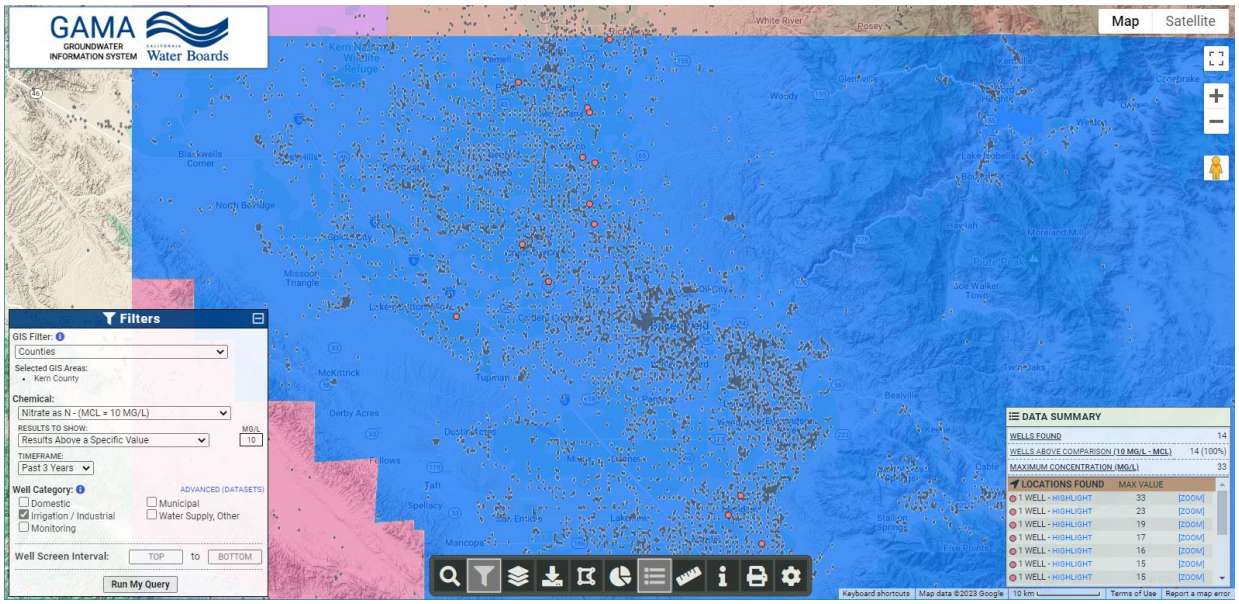




Select your filter first (here I've chosen "counties"). Then GO TO THE MAP to click on the county you want to view.

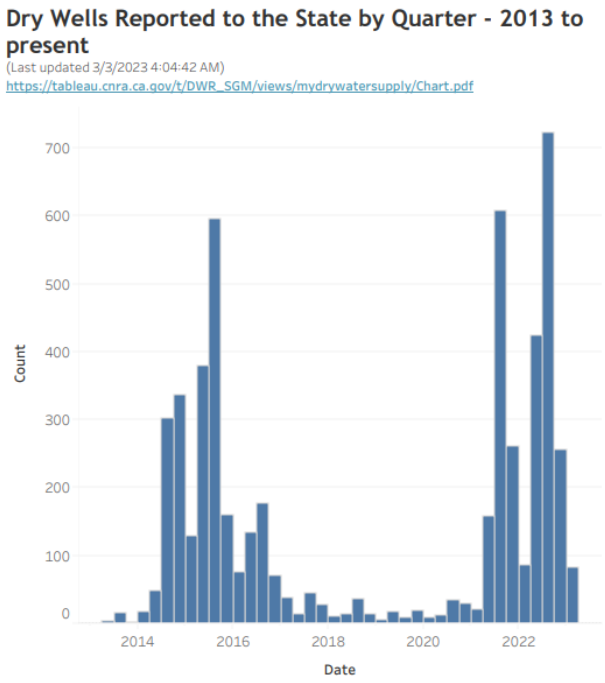
Here I've chosen Kern County. Then I can continue my query for the chemical I'm interested in. So, if I want to know where there are irrigation wells that exceed the drinking water standard for nitrate-N in the last 3 years, the query would look like this.

Hit "Run my Query" to see results:



Drinking (ground)water, source (ground)water protection, and (ground)water quality

In 2012, California became the first state to officially recognize a human right to water, and since that time has been making significant efforts to ensure safe, affordable and adequate water supplies for all Californians. Thirty-three million people in this state (83 percent of the population) depend on groundwater for some or all of their home use, and 6 million people in small communities are 100 percent groundwater dependent. Many of those are people living in rural areas with their own small domestic well.



Of course, agriculture is also happening in these same rural areas. In California, 70% of all irrigation water comes out of the ground, and agriculture accounts for 79% of all groundwater use. Ag wells are usually large capacity, deep wells, and are often suspected of drawing down water tables to the point where nearby domestic wells go dry. During the recent droughts, thousands of small domestic wells have gone dry.

Even if a well doesn't go dry, a well user may be faced with lack of water if the water quality is poor. Agriculture plays a role in water quality impacts because nitrate from fertilizer and manure is a widespread contaminant in California's groundwater.

There are several state programs working to address these issues. The big one is SGMA, which aims to ensure sustainable groundwater levels at the basin scale. The Department of Water Resources recently rolled out LandFlex, a program that pays farmers to reduce or eliminate the use of ag wells near disadvantaged communities with water supply issues. The Irrigated Lands Regulatory Program, enforced by the Regional Water Quality Control Boards, is designed to identify, and reduce pollutants from agriculture to surface and groundwater. In the Central Valley, Nitrate Management Zones are providing drinking water to rural residents whose wells exceed safe levels of nitrate, as an immediate response to drought conditions through the Nitrate Control Program.

NRCS has a couple of programs that can address groundwater quality:

- the National Water Quality Initiative Program, which works at a watershed level to address water quality issues in general and to protect drinking water sources; and
- the Source Water Protection program which allows each state to increase funding for practices to protect water quality in priority watersheds. You can learn more about that on the Water Quality SharePoint page.

So what is a conservationist to do? How can we help reduce these negative impacts on groundwater supplies? Here are some connections.

Human Right to Water | California State Water Resources Control Board

Programs: DWR LandFlex, NRCS Source Water Protection, NRCS NWQI

Overview of groundwater use in California: ca.pdf (ngwa.org)

Critical Aquifer Overdraft Accelerates Degradation of Groundwater Quality in California's Central Valley During Drought - Levy - 2021 - Geophysical Research Letters - Wiley Online Library

Conservation planning for groundwater

In 2019, NRCS added Groundwater Depletion to the NRCS list of official resource concerns, opening the door to directly addressing this critical issue in California. There are several approaches to conserving water in the ground, many of them actions farmers can take using our conservation practices.

- We can reduce demand for groundwater by improving irrigation efficiency through management and technology upgrades.
- We can use soil health practices like cover crops and reduced tillage to build a farm's water holding capacity and to fill up the root-zone water storage with winter rains, maximizing the so-called "green water" available at the beginning of irrigation season.
- We can keep more water in the ground by using surface water for irrigation when possible- this is known as "in-lieu recharge".
- We can deliberately apply extra water to farm ground during the off-season to recharge groundwater- the agricultural flavor of Managed Aquifer Recharge, or Ag-MAR.

On that last point, NRCS California used the Ag-MAR work being done in state by farmers and researchers and developed two interim practice standards that would allow us to do Ag-MAR under our financial assistance programs. The two standards are On-Farm Recharge and Groundwater Recharge Basin or Trench. Data from these two practices are still being reviewed before extension to the entire state.

NRCS has long-standing resource concerns regarding groundwater quality. These are:

- Nutrients
- Pesticides
- Pathogens and chemicals from manure, biosolids, or compost
- Salts
- Petroleum, heavy metals, pollutants

} transported to groundwater

Managing for groundwater quality is especially difficult for a couple of reasons. First, there's a time lag between management changes on the land surface and any measurable improvement or degradation in a well's water quality. Those time lags can be months, years, or even decades depending on the geology of the aquifer and other factors! Second, it's not easy to know which direction groundwater will flow, and so it's hard to understand where management changes will have the most benefit. It's a little bit like playing Pin the Tail on the Donkey- we know there's a donkey out there that needs a tail, but we can't exactly see where to put that tail!

In most cases we end up identifying a groundwater quality resource concern based on nearby monitoring well data or by assessing the risk of current farm management practices, like nutrient management or agrichemical storage areas. Based on that, NRCS recommends conservation practices that have the best likelihood of reducing risk.

Groundwater recharge EQIP pilot program

Winter of 2022-23 has been the first in which NRCS California funded groundwater recharge practices through EQIP. Those practices are On-Farm Recharge, in which actively-farmed fields are deliberately flooded, usually in the off-season; and Groundwater Recharge Basin or Trench, in which an excavated structure collects water and allows it to infiltrate. The goal with these practices is to help extend the practice of agricultural managed aquifer recharge, or Ag MAR, more widely in the state to the benefit of groundwater supplies.

These Interim Practice Standards were developed by engineering staff here in California and approved by National Headquarters in 2020. In 2021, CA started working with technical advisors from Sustainable Conservation to develop our pilot program. Staff did the internal NRCS work like getting payment scenarios developed and approved and setting up all the fund pool parameters; Sustainable Conservation helped us identify good areas for our pilot program and ways to effectively rank projects based on site suitability. Together we developed technical products like site suitability parameters, ranking questions and template Implementation Requirements that will be useful in the future when these practices are added to Section 4 of the Field Office Technical Guide and available statewide. Sustainable Conservation is also helping NRCS monitor the projects as they are implemented and is hosting information about our program on their website.

Photo 1: Water is applied to a dormant vineyard for the purpose of groundwater recharge, February 2023.

Thanks to a crack team of NRCS engineers and conservationists in the Area and Field Offices in Area 3, NRCS has about 20 participants in the first year of the pilot program. Funded projects include over 3,000 acres of on-farm recharge and several recharge basins ranging from 1 ac-ft capacity up to 50 ac-ft. After the atmospheric rivers came through in early January this year, the irrigation districts started delivering that extra water through their canals and farmers started putting it on their fields. Our projects were mostly on vineyards and tree crops, with a few annual crop fields thrown in; our basins hadn't finished construction at that time so we're hoping they can take advantage of later water deliveries this spring.

In the annual report to National Headquarters this spring NRCS asked for a little more time for our pilot program, in the hopes that we might have more than one year of wet weather to evaluate the practices. In the meantime, we are collecting valuable feedback from our participants, our field staff, and our partners on how the practices are working within our programs and how we might make them better. This could be an important way NRCS contributes to addressing the large-scale resource concern of groundwater depletion.

California Water Agencies Hoped A Deluge Would Recharge Their Aquifers. But When It Came, Some Couldn't Use It - Water Education Foundation