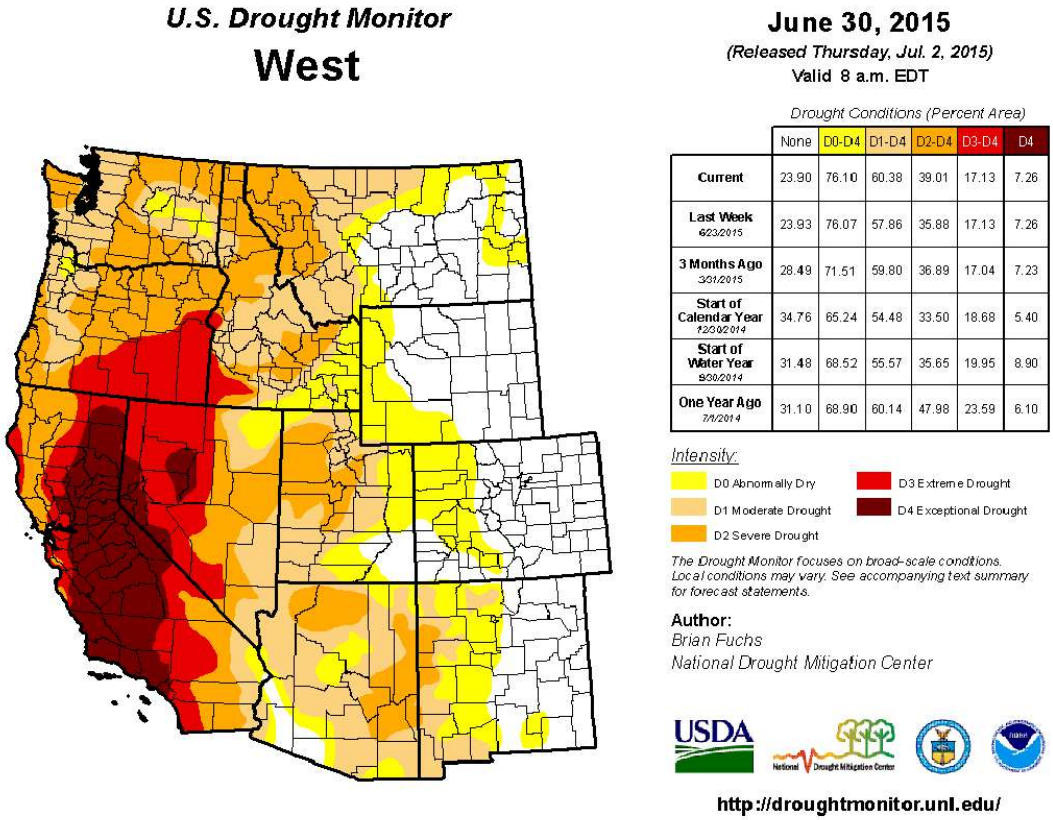
Chuck Houser



A drought map of the western U.S. from June 2015 shows the intensity of the drought, particularly in California. **Image courtesy of the National Drought Mitigation Center**

(water)

Can groundwater keep your course green?

Groundwater can be a replacement or a backup for the municipal water supply, as well as a budget saver and an insurance policy when water is scarce.

On May 3, 2016, roughly one-third of the contiguous United States was suffering from drought, according to the National Drought Mitigation Center. One year later, drought conditions have improved, and the areas afflicted by drought make up only about 17 percent of the country, but that doesn't mean the drought is over. Parts of the western, southeastern and northeastern U.S. are still suffering from the long-term effects of drought, and will likely be slow to recover.

In their quest to maintain their turf in times of water scarcity, golf course superintendents have reduced water use, decreased acreage of irrigated turf, and experimented with various sources of water. A source that deserves consideration but may not be top of mind for many courses is groundwater.

Groundwater: An alternative?

When is groundwater an appropriate alternative for water supply? When there is enough of it. Simple, right? Maybe. Groundwater stock is determined not only by the quantity and quality of water contained in an aquifer, but also by the ease with which the water can move into a well or to a spring where it may be available for use. A hydrogeological assessment is a way of collecting pertinent information to determine whether adequate groundwater is available — at a low enough cost — to provide a water supply.

A drilling rig in coastal central California. Installing a supply well for groundwater requires about 100 square feet for the well, as well as room to navigate a 35-by-10-foot truck and sufficient clearance to raise a 35-foot drilling mast. **Photo by Chuck Houser**

Hydrogeological assessment

The first step in a hydrogeological assessment is information gathering. Surrounding water supply districts as well as private or industrial users may be able to offer data on existing groundwater production that would be helpful in evaluating whether groundwater is a viable option. After assembling and studying the information, a hydrogeologist will look at the proposed user's property for possible groundwater wells. A completed well, including its well house, generally occupies a space of about 10 by 10 feet. It's easy to find 100 square feet for the well, but the area must also accommodate the drill rig, a support truck carrying all the drill pipe (1,200 to 1,500 feet of pipe is not uncommon), and other support equipment. Can you drive a 35-by-10-foot truck into the well area and back it up to the well location? Once on the well site, can you raise the 35-foot-tall drilling mast without hanging up in trees or overhead power lines? Once the well is completed, will it require space for a treatment system? All of these criteria must be considered when siting a well.

Water rights

The hydrogeologist (and possibly your attorney) should determine whether you have the right to use groundwater. In general, landowners have the right to the groundwater beneath their property, but this isn't always the case, and your rights can usually be clarified by your municipal water provider.

An example: An industrial facility in Southern California that uses about 3 million gallons of water per day was interested in groundwater as an alternative water supply. The hydrogeologist determined the facility was in a groundwater basin that was subject to the state's Sustainable Groundwater Management Act and had been designated a high-priority basin, meaning it faces potentially serious problems with groundwater overuse (overdraft). The part of the basin where this facility was located was also adjudicated, meaning groundwater use was controlled by what's known as a "watermaster," appointed by the courts in a water rights settlement.

The likelihood of that facility using groundwater seemed remote until the hydrogeologist contacted the water supplier and was subsequently referred to a consultant working for the watermaster service. The consultant indicated the facility should have no problem obtaining a water right. Although groundwater levels in the basin were in decline overall and needed to be carefully managed, the facility was in a portion of the basin with abundant groundwater and virtually no groundwater-level downturn. In this case, the hydrogeologist gleaned these details during the initial research for the hydrogeological assessment.

If groundwater seems to be a feasible option based on other users, if a suitable location or locations exist for possible wells, and if you can establish your right to use the groundwater at your site, you're ready for the next step, which will be pricey.

Test wells

Groundwater production wells are based on the types of geologic formations, the required drilling methods, and the depth necessary to ensure an adequate water supply — and they're expensive. If groundwater appears viable and a suitable location for a well has been identified, drilling a test well may be an appropriate first step. Test wells are typically drilled at a smaller diameter than supply wells, which means they can be drilled faster and at a lower cost. They also may not be drilled to the full depth of the eventual supply well. Test wells are pump-tested only long enough to gather the aquifer information needed to estimate well yield, and they can, in conjunction with aquifer test pumping, be sampled to evaluate water quality. Armed with this information, you can make the decision (based on real aquifer data) whether to shoulder the expense

The Bidwell Marina, Lake Oroville, Calif., is pictured in 2011 before the drought (top), and then during the drought in 2014 (bottom). The drought broke in some parts of the state, including the Oroville area, in 2017, but parts of Southern California are still experiencing abnormally dry to severe drought conditions.
Photos by Paul Hames/California Department of Water Resources

of drilling, installing and developing a supply well. The hydrogeologist should be made aware of any permitting requirements for test and supply wells.

Where groundwater can be extracted and used, the supply may be limited by the number of users in addition to the amount of water. Groundwater extraction must be sustainable, and every aquifer has limits. Test pumping — particularly if existing nearby wells can be monitored for response during pumping of the test well — can be helpful in evaluating whether groundwater removal may affect other groundwater users.

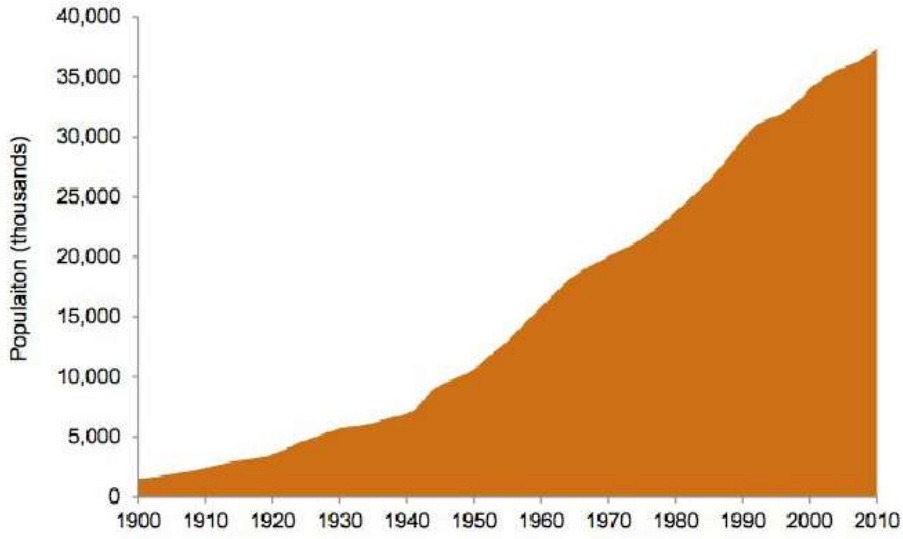
Groundwater use: Good for all?

Using groundwater may be a way to reduce the strain on water resources in California and other water-scarce areas in the region. Imagine the best-case scenario: You are situated in a groundwater basin with abundant groundwater, the groundwater quality is good, and extracting that groundwater will not adversely impact the resource or other groundwater users. Your municipal water supply comes from a provider that taps the Colorado Aqueduct, which may not be able to provide a sustainable water supply for population growth in Southern California and Arizona. And you are under a mandatory water conservation order and are unsure whether you can even meet the cutback requirements and still maintain your property or business.

The initial cost of drilling a supply well will typically be offset by ongoing savings, not only because the cost of water will drop, but because you can maintain a level of water consumption that sustains the optimal income from the golf course. By using groundwater, you are able to maintain your business the way you'd like, and you shrink your water consumption footprint in the overall water resources of the state. You are conserving by using water that is available only to you — the groundwater beneath your property.

When considering whether to drill a supply well, be mindful of what the future may bring. Today's water rates may be manageable, and the supply may be adequate with no indication of a reduction in the resource. These circumstances could shift, however. Decreases in supply will likely lead to stricter water use restrictions and conservation measures — and increased prices. If you depend on the municipal water supply, and if a well could provide a suitable quantity and quality of water for your course, installing one is a good backup plan.

California has experienced rapid population growth



California's population growth has soared since the 1970s, straining water resources, particularly in the desert areas in the southern part of the state. Graph based on estimates from the California Department of Finance and the U.S. Census Bureau.

An imperfect solution

What if groundwater won't solve your water supply problems forever? Groundwater rarely provides a perfect alternative. Either the quality is good but the available water is insufficient, or the water is plentiful but the quality is not adequate — or, more likely, water is not sufficient for all your needs and water quality could be better. This is where the evaluation by the hydrogeologist and the results of test well pumping and sampling become critical. Groundwater doesn't have to be a complete solution to a water supply problem if the cost is within reason.

Suppose the water quality is good but the well simply doesn't produce enough water to meet all of your needs. If meeting a portion of your water needs saves enough money to offset, within a reasonable amount of time, your cost to use groundwater, then you've arrived at nirvana light. Similarly, if the quantity is good but the quality needs help, give it the help it needs. Most likely the well has quality issues that need to be addressed and it doesn't provide quite enough water. Just figure your costs before drilling.

To determine whether drilling a well is a financially viable option, you need to know its capital cost, how much of your water supply the well can offset, and the cost of treatment, if any, to meet your water quality needs. Calculate the ongoing costs associated with wells and using groundwater. Well pumps don't last forever. Some water companies I know have pumps that have lasted around seven to 10 years. The cost of replacing a pump includes not only the price of the new pump but the cost of taking out the old pump and replacing the piping. Ongoing costs may include filtering or retreating the well water. Filter or treatment media may need to be periodically replaced or backflushed, and filtration systems generate filtered byproducts (metals, brine, etc.) that need to be disposed of. Knowing how much water you will generate and what treatment will be needed (information from the test well pumping and sampling) should allow you to estimate these ongoing costs. Put it all together and compare it with what you're paying for municipal water, and it won't be hard to see how long it will take a well to pay for itself, and whether cost savings will also cover ongoing costs.

It ain't over till it's over (and it ain't ever over)

Say the hydrogeologist has done an evaluation of possible groundwater supply, and water quantity and quality appear to be adequate based on information from other water users in your area. You have a suitable location for a well, with enough space for a drill rig to create it, and there are no impediments to asserting your right to the groundwater. The test well reveals adequate yield to meet at least a portion of your needs, and water quality will require only minimal treatment. The cost of drilling the well coupled with ongoing maintenance and treatment costs show a net savings over the price of using municipal water. The well has been drilled and the treatment system installed. You now have a virtually perpetual supply of water from your own property. Time to sit back, relax and enjoy, right? Only if nothing in the groundwater basin and, particularly, in the vicinity of your facility ever changes.

Conditions and water use in the basin will likely change, and these changes could affect your use of groundwater. Be sure to monitor groundwater conditions and developments that may impact your use. You don't have to implement your own basin-wide groundwater monitoring program. Monitoring can be as simple as periodically checking a few resources that already monitor and report groundwater conditions. For instance, the California Statewide Groundwater Elevation Monitoring (CASGEM) program collects groundwater elevation data that are available online through the California Department of Water Resources. An interactive map (http://gis.water.ca.gov/app/gicima) provides public access to the CASGEM material, as well as information about priority groundwater basins, adjudications and existing groundwater management plans. Keeping in touch with your hydrogeologist may make keeping up with the groundwater conditions in your area even easier.

Even when groundwater supplies can meet the needs of your golf course, taking additional steps to reduce water consumption is prudent. Minimize the footprint of the irrigated turfgrass, and plant xeric landscaping that is native to the area and requires much less irrigation. Choosing to be water-wise demonstrates to the public that the golf course is interested in being part of the solution to a regional drought.

Using groundwater is a privilege that may allow you to reduce water supply costs and better meet water conservation goals while reducing strain on an already stressed resource. With privilege comes responsibility — to use the resource appropriately and carefully (that is, not to overuse groundwater). It has been said that "Whiskey is for drinking and water is for fighting over." This is truer than ever as western states in the U.S. come out of a historic drought, and as the golf industry becomes even more aware of the value of water.

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