Off the Grid

The 300-Well Groundwater Monitoring Program for Southern Los Angeles County Was an NGWA Ground Water Protection Award Winner in 2011

BY REBECCA VANDERMEULEN

Clean, fresh water is a precious resource especially in southern Los Angeles County, California.

The average annual rainfall hovers around 15 inches in this 420-square mile area nestled against the Pacific Ocean. Groundwater aquifers can be subject to contamination from sources such as volatile organic compounds (VOCs) from industrial solvents that were improperly disposed of through the years at manufacturing sites in the region.

Almost 4 million people who live in 43 cities in this area rely on the Water Replenishment District (WRD) of Southern California to responsibly manage the groundwater supplies they use in their daily lives.

To maintain an adequate supply, the WRD imports some water from faraway sources including the Colorado River and snowpack from the mountains of northern California. Recycling wastewater yields even more supplies for irrigation and groundwater replenishment, and a desalination plant in operation since 2001 treats about 8.4 acre-feet of water daily.

However, groundwater remains an important source for the residents of southern Los Angeles County. The WRD's service area consumes about 250,000 acre-feet of groundwater from aquifers in two basins each year. This figure constitutes almost 40% of the area's total annual demand for water.

Figure 1. A hydrogeologist from the Water Replenishment District of Southern California takes a groundwater sample at one of its 300 wells that are a part of its monitoring program.

In such a heavily populated region—and one that relies so heavily on nontraditional sources of fresh water—it is imperative to keep a close eye on existing groundwater supplies effectively.

As recently as the mid-1990s, though, the WRD did not have an effective monitoring program. And as recently as 1994, the district monitored groundwater conditions by relying on information from other entities, including the California Department of Water Resources and Los Angeles County Department of Public Works.

The WRD had no wells dedicated to monitoring water quality and watching for contamination.

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Figure 2. Completed nested monitoring wells for WRD's monitoring program. Each nested well taps a major aquifer.

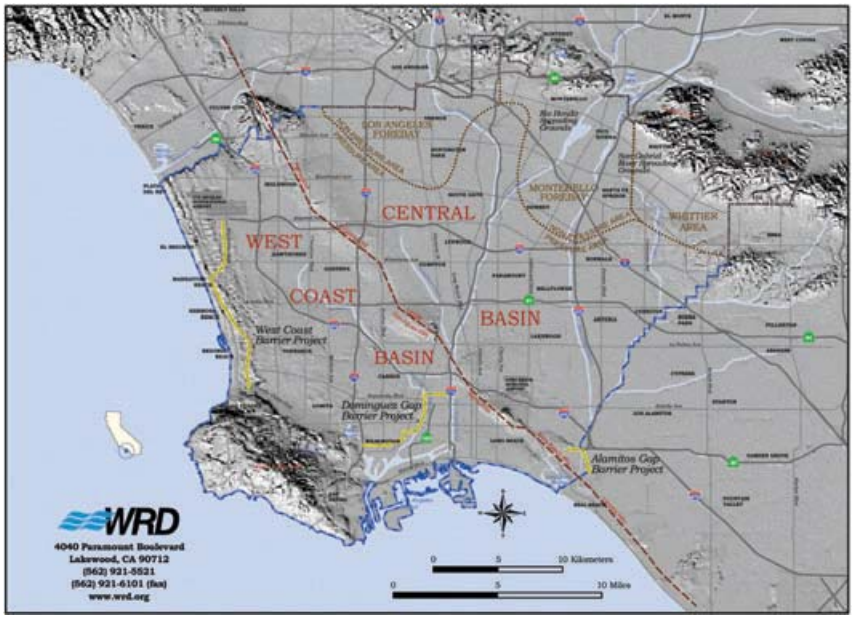

Figure 3. The Water Replenishment District of Southern California. It covers 420 square miles.

Production wells provided some information, but it was not reliable because the wells crossed several layers of aquifers. That meant any water-quality readings from a production well would provide average readings from all of the aquifers instead of showing data from a single aquifer. Problems were hard to isolate.

"There's at least 10 major aquifers that go about 2000 feet deep, and they are each their own character," says Ted Johnson, PG, CHG, chief hydrogeologist for the WRD.

The WRD and U.S. Geological Survey (USGS) began working together in 1995 on a project to build monitoring wells throughout the district's service area. Now there are about 300 altogether spaced in a grid pattern generally between two and three miles apart. The project, which has so far cost an estimated $15 million, was honored with an NGWA (National Ground Water Association) Ground Water Protection Award in 2011.

Developing a System of Monitoring Wells

In addition to the deficiencies that came with monitoring water quality under its previous system, natural characteristics of the WRD's service area create conditions that require regular inspection that produces accurate results.

The two groundwater basins—called the Central and West Coast basins—that comprise the WRD's service area are separated by a series of faults running southeast toward the Pacific Ocean, which create partial barriers to the natural flow of groundwater. Additionally, some aquifers in the Central and West Coast basins sit next to the ocean and are vulnerable to saltwater intrusion that the WRD combats by injecting fresh water into wells at three strategic locations. Johnson explains that much of the managed groundwater recharge process in southern Los Angeles County begins at saltwater barrier wells and in an inland area called the Montebello Forebay in the northeastern section of the Central Basin.

Manmade contamination abounds as well. Oil and gas drilling is a significant industry in the region. The sites of petroleum processing, aerospace manufacturing, and other industries have caused VOCs to leach into the ground.

Eric Reichard, Ph.D., director of the Pacific Southwest area of the USGS California Water Science Center, explains that in the early 1990s his office began studying the recharge of treated, recycled water in the northern part of the Central Basin. The USGS then began testing for chemical and microbial content of reclaimed water. Reichard's office began working with the WRD on its groundwater monitoring project out of a desire to combine all of the data that existed about the state of groundwater in the area.

"The idea was to get a three-dimensional picture of the water system and water quality," Reichard says. "It's been a really wonderful partnership from our perspective. They really value the science."

As there were few wells used for monitoring, the first step was to install monitoring wells in four key locations that represented where most of the groundwater supply came from. The goal of the two agencies was to get a more specific idea of how the groundwater flowed throughout the area, along with a better understanding of the flow of seawater that intrudes into the groundwater.

The WRD and USGS have added nearly 300 more wells at about 50 different locations. Johnson explains that there are about five nested wells installed in each borehole. Each well taps a major aquifer. Most are made of polyvinyl chloride (PVC) pipe 2 inches in diameter with 20 feet of screen at the end to allow the groundwater to enter the well.

WRD staff members collect water-quality samples from each well twice

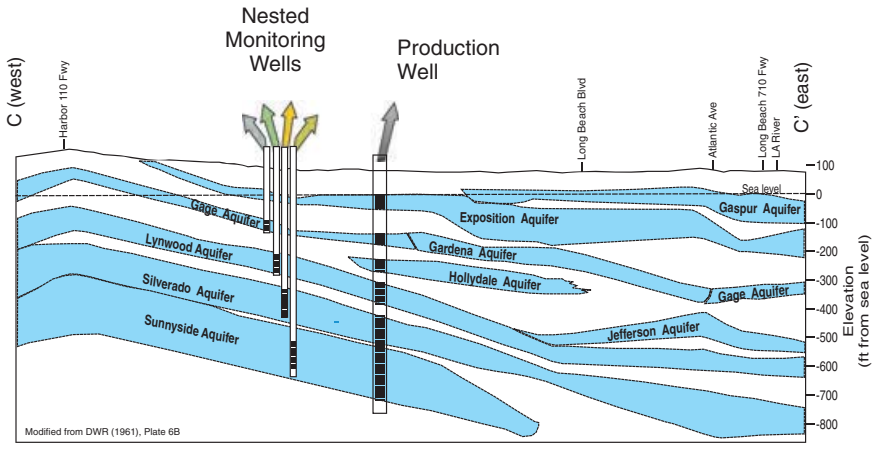

Figure 4. Nested wells vs. production wells for aquifer specific data.

a year and measure water levels at least four times annually (Figure 1). Additionally, permanently installed data loggers measure water levels inside most of the wells every 6 h.

"We can see short-term spikes, short-term drops, in addition to long-term trends," Johnson says.

The WRD's hope is for each monitoring well to last for at least two decades. The most difficult part, Johnson says, is figuring out exactly where to drill each one. Because the district usually places its wells on publicly owned land, it has to work with local governments in each of the 43 cities it serves.

"We don't own any of the land that the wells are located on," he explains. "It could take three to six months by the time all the paperwork is in order."

The WRD prefers places such as parks and municipal parking lots. Unlike a street, for example, drilling a well in a parking lot is minimally disruptive. The district also employs staff members who are tasked with explaining the importance of groundwater monitoring to the public. Representatives of the WRD, including Johnson, visit neighborhoods where wells are to be installed and even give out their personal cell phone numbers to take questions about the drilling of monitoring wells. Johnson says he's never received a call from a resident (Figure 2).

Plans call for the entire complement of about 325 wells to be drilled by the middle of 2014.

Improved Groundwater Supply Forecasting

The WRD's work with the USGS is resulting in benefits beyond improved groundwater monitoring. The agencies are working together to develop an 11-layer groundwater flow model of the district's service area—far more advanced than the 4-layer model that is in use now. Johnson estimates that the 11-layer model will be finished by the middle of 2013.

When it is complete, the WRD will be able to make more detailed predictions about the groundwater supply that will exist over the next several decades. Having more accurate data allows the district to better prepare for disruptions to southern Los Angeles County's groundwater supply, such as rising sea levels or decreases in snowpack in the northern part of the state (Figure 3).

"It's a more integrated suite of information," Reichard says. "It's this melding of two complementary objectives that has made this such a rewarding project."

Significantly, this in-depth analysis of hydrologic and geological data shows evidence of previously unavailable groundwater (Figure 4).

Reichard explains that data provides additional information about groundwater that flows from the Montebello Forebay, already a prime source of water for the WRD's service area. Evidence of a geologic syncline has shown that groundwater may

Figure 5. A team advances drill bit as one of the wells in the monitoring system is drilled.

exist deeper underground than previously explored—perhaps as deep as 3000 feet, compared to the maximum 1500-foot depth that production wells in the area are drilled to now.

Johnson says the WRD is currently planning to drill a research well by the beginning of 2013 to assess whether this aquifer exists (Figure 5). If it does, residents of southern Los Angeles County could use a higher percentage of local water, since the WRD would have to import less from far-flung locations.

"Everybody around here gets excited when they hit oil, but we get more excited when we hit water," Johnson says.

Rebecca VanderMeulen *is a freelance writer living in southeastern Pennsylvania. Her work has also appeared in NGWA's* Water Well Journal.

Award Details

Information on the National Ground Water Association's awards program is available on its Web site. Find out past winners and how to honor industry leaders and outstanding projects. Go to www.ngwa.org/About/awards/.