Keeping the Pump Primed: Groundwater Sustainability

By John Jansen, Ph.D., PG, RGp

You can't manage what you don't measure. These are simple but powerful words. To manage a system you need to gauge the state of the system and calibrate management actions to achieve desired outcomes. This applies to systems as simple as tying your shoe and as complex as the national economy. It also applies to far more complex systems like groundwater management.

The key to effective management is data—data on current conditions as well as data on past conditions. It is by correlating historic inputs and outputs of the water balance we develop models of the system that help us understand the dynamics of a system and allow us to make reasonable predictions of future conditions. Only then can we gauge the impact of proposed interventions to alter future conditions—no data, no tools to manage the system. Fortunately, our predecessors understood this concept. The U.S. Geological Survey and many state and local agencies have been gauging stream flow and groundwater levels for more than a century.

Unfortunately, our generation of hydrogeologists has not been as diligent as we should to maintain and build on this monitoring legacy. Stream gauges and groundwater monitoring wells are lost to budget cuts every year. All but a few states have seen their monitoring efforts decrease. Just when the pressure on the resource is reaching critical levels, we are losing our ability to capture the data we need to adapt to future conditions.

Leonard Konikow of the USGS recently published an assessment of the depletion of 40 major aquifer systems in ***Groundwater Depletion in the United States* (1900–2008)**. His analysis rested on basic monitoring data and the computer models and analysis made possible because of that data. He found the cumulative depletion of these aquifer systems is on the order of 1000 cubic kilometers in Figure 1. The rate of depletion accelerated after about 1950 and reached its highest rate during the latest period (2000 to 2008). This is the type of analysis policy makers need to understand the condition of the resource and make informed management decisions. As our monitoring networks are allowed to unravel, we place at risk our ability to test the accuracy of our current predictions, evaluate the success of our management practices, or make better predictions in the future.

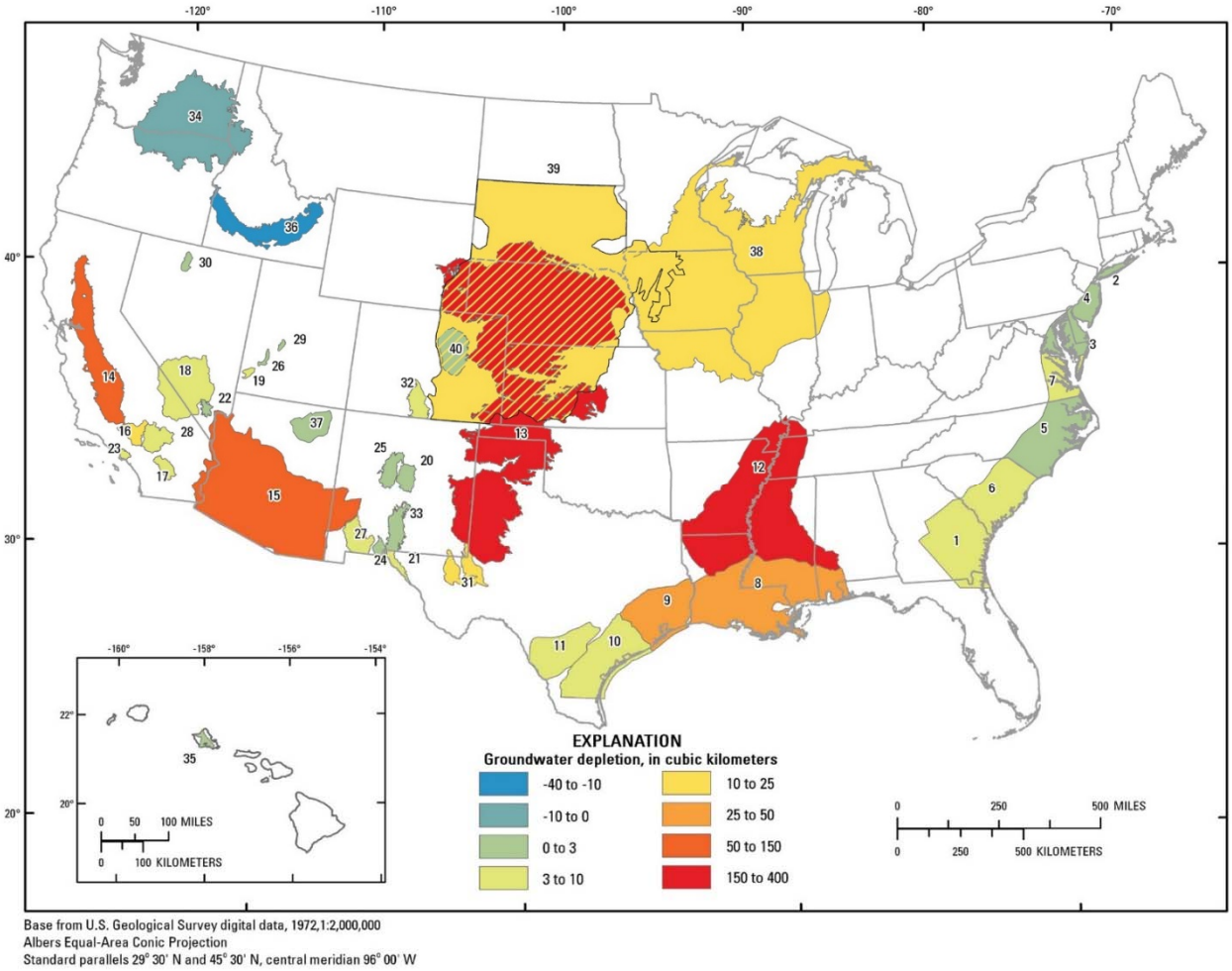

Figure 1 (above). Map of the United States (excluding Alaska) showing cumulative groundwater depletion, 1900 through 2008, in 40 assessed aquifer systems or subareas. (Konikow 2013)

Monitoring is a tedious business. It is not as glamorous or noteworthy as basic research or ground-breaking studies. As a result, monitoring budgets are often cut to preserve the higher profile research and analysis. Ironically, it's usually the data from previous monitoring that makes the new research possible. In the pressure to show relevance to funding agencies, we are sacrificing long-term monitoring that is the key to future research and analysis.

There have been several significant initiatives in the last few years to reverse the downward trend in monitoring. The Advisory Council on Water Information, a Federal Advisory Council, formed the Subcommittee on Ground Water (SOGW) in 2007 and directed them to develop a National Ground Water Monitoring Network (NGWMN). SOGW published a framework document in 2009 and opened a data portal to facilitate the dissemination of data in 2011. The framework report documented the state of groundwater monitoring around the country and provided recommendations and guidelines for future monitoring.

Figure 2 summarizes the distribution of water level monitoring well networks in the United States. Eight states have no monitoring network and five states have regional networks but no statewide network. The remaining 37 states have monitoring networks that vary in quantity and quality in terms of coverage. Only 17 states report having a statewide water quality monitoring network. Most states have experienced frequent budget cuts for monitoring and have been forced to retire wells and reduce monitoring frequency.

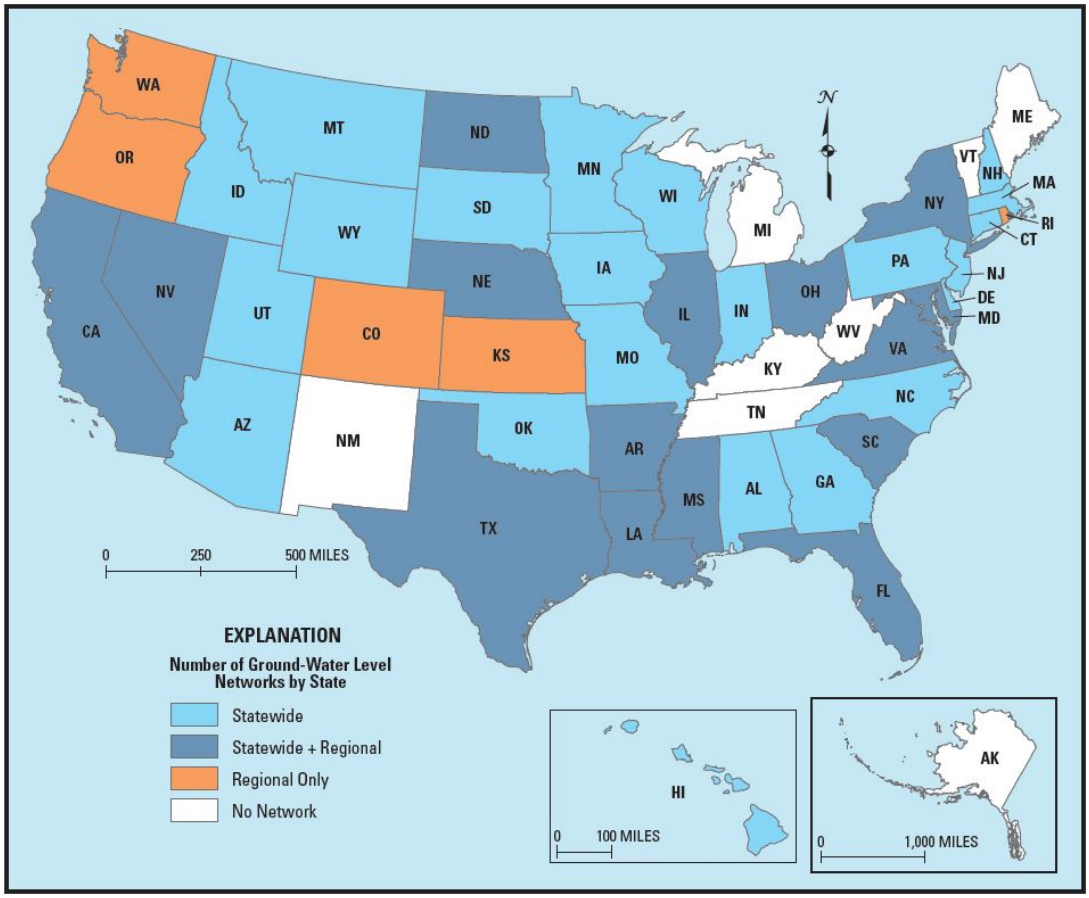

Figure 2 (above). Map of groundwater level monitoring networks in the United States (SOGW 2009, revised 2013)

NGWA led an effort earlier this year that resulted in 30 major national and state water organizations signing a letter supporting NGWMN funding. That combined effort continues with NGWA members and its partners meeting with Congressional offices to reinforce the letter's message. Overall, the Appropriations Committees have expressed their commitment to moving FY 2015 funding bills through Congress. While not guaranteed, prospects are encouraging that the final bill will include money to allow a partial start-up for the NGWMN and begin the process of rebuilding the monitoring system.

While many states face declining monitoring budgets, at least two states are increasing their efforts. Minnesota has one of the best groundwater monitoring programs in the country. It currently

monitors more than 900 wells through direct ownership and a variety of cooperative agreements. The network has grown significantly since 2008 thanks to new funding from state environmental funds and a portion of local sales taxes. The state is actively using the data to guide state water management policies.

California has traditionally made most aspects of groundwater use confidential, which limited the data available for regional water studies. But the state passed in 2009 legislation enacting the California Statewide Groundwater Elevation Monitoring (CASGEM) program. The CASGEM program mandates groundwater monitoring to track seasonal and long-term trends in groundwater levels. This program will coordinate and build on the existing regional and local monitoring networks and make the data available to the public. It is viewed as a large step forward to more effective water management.

Our generation of hydrogeologists has probably been forced to face the limits of our groundwater resources more than most of our predecessors ever imagined. Unfortunately, future generations will face larger challenges than we can imagine. Let's hope that we are beginning a resurgence in our appreciation of our monitoring responsibilities and future generations will look at us as acting responsibly as forward-looking stewards of the resource in much the same way we look back with reverence to our predecessors who glimpsed future needs and did the monotonous work of measuring and monitoring that provide the framework for managing our resources to protect humans and our environment.

John Jansen, Ph.D., PG, RGp*, is a senior associate and hydrogeologist for* ***Leggette, Brashears and Graham Inc****. Jansen works on a wide variety of groundwater projects around the country, specializing in high capacity wells and groundwater resource management. He received the* ***NGWA Keith E. Anderson Award*** *in 2012 for service to NGWA and the groundwater industry and was the speaker for the* ***2013 NGWREF McEllhiney Lecture Series in Water Well Technology****. Jansen holds three U.S. patents on water well-related technologies and is the lead author of the chapter on borehole geophysics in the third edition of* ***Groundwater & Wells****, published in 2008.*

Reprinted from the April 18, 2014 *NGWA Newszine* with permission of the National Ground Water Association. © 2014. All rights reserved.