# Charting Paths Forward for a Heavily Stressed Aquifer

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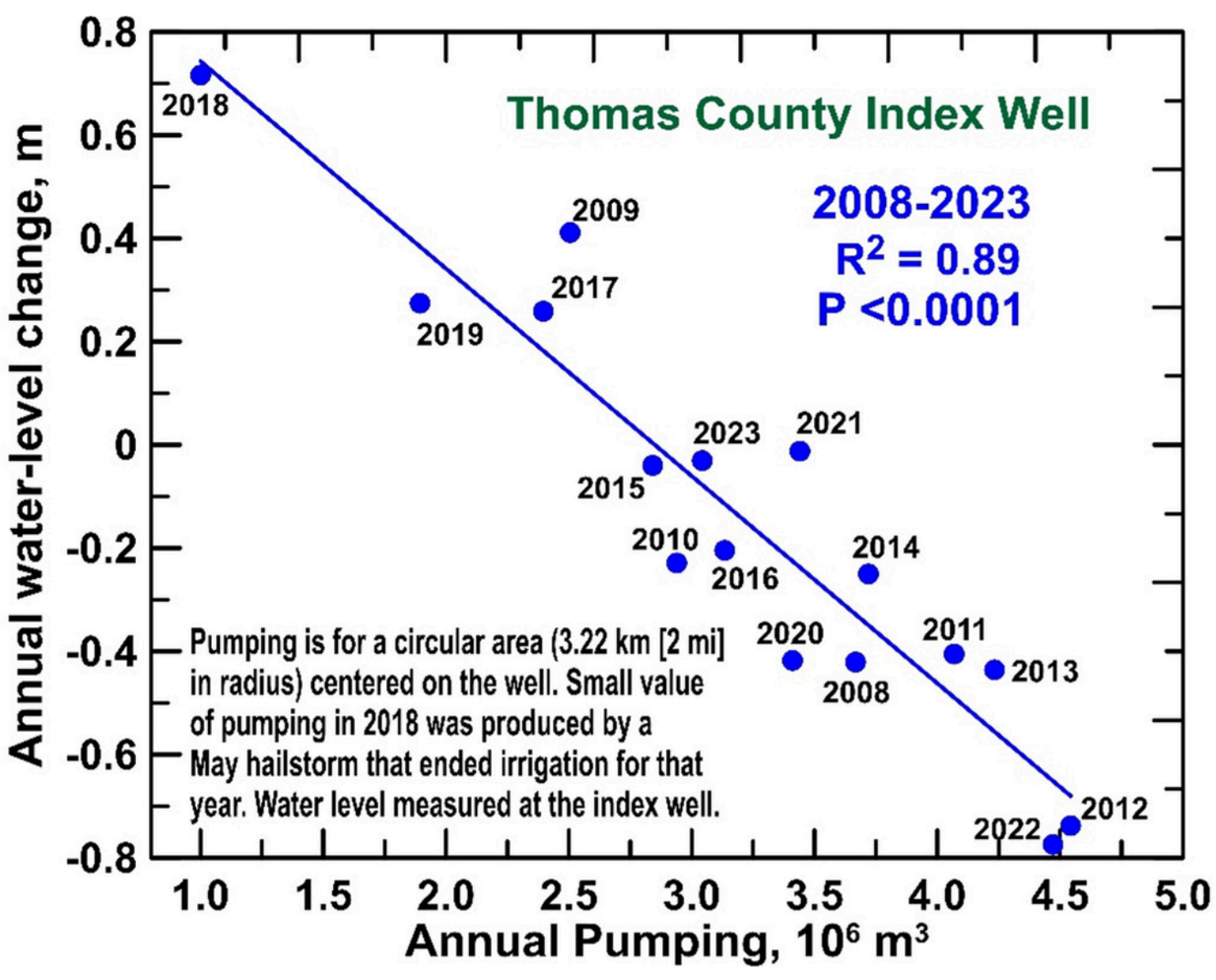
Addressing the depletion of aquifers that support irrigated agriculture and provide drinking water for millions is a global challenge. Like many regional aquifers, the High Plains aquifer (HPA) in western Kansas is under stress produced by decades of intensive pumping for irrigation. The large water-level declines pose an existential threat to the viability of irrigated agriculture and the rural communities that depend on it. There is only one option to reduce that threat in the near-term: pumping reductions in conjunction with modification of agricultural practices. How much reduction is needed is the key question.

An assessment of data from a network of Kansas Geological Survey (KGS) continuously monitored index wells found indications of a steady net inflow to the areas around those wells. Using the KGS database of annual water-level measurements (about 1,400 wells) and annual pumping data (all non-domestic wells are metered), we found strong linear relationships between annual pumping (Q) and water-level change (ΔWL) from the local (Figure) to regional (up to 21,000 $km^2$) scale, an indication that a steady net inflow is likely a common feature across the Kansas HPA. This led us to develop a method to calculate net inflow from a plot of Q versus ΔWL. If water levels are to be stabilized for the next one to few decades, pumping must be reduced to net inflow ($Q_{stable}$).

Results from groundwater conservation areas in western Kansas demonstrated the potential of the $Q_{stable}$ framework for broad application. The path to widespread use, however, required us to move far beyond papers in peer-reviewed journals.




In the last decade, we have given numerous presentations to irrigator groups, groundwater managers, legislative committees, and many others. We have also written for non-technical audiences ranging from the general public to theologians. As a result, $Q_{stable}$ is commonly invoked by agricultural groups and legislators in Kansas and is being widely adopted as the target for conservation efforts. Although reductions to $Q_{stable}$ will not attain sustainability in most areas, they will exploit the inertia in unconfined aquifers with deep water tables to buy time to develop longer-term strategies and thus serve as initial steps on a path to more promising conditions in the western Kansas HPA.

Want to showcase hydrology research making a real-world impact? Nominate yourself or a colleague for an upcoming “Science to Solutions” feature by emailing us at agu.hydro.news@gmail.com.