What is the Relationship Between Water Levels in Wells and Groundwater Quality and Quantity ?

There are many variables that influence groundwater quality. Aquifer rock type, soluble minerals present and their concentration, groundwater flow paths through the aquifer, contact or residence time, and recharge rates are examples of variables that influence groundwater quality. Other factors such as well depth, use, and well construction can also control water quality in a well.

In general, groundwater quality with respect to water level changes is small. However, in certain situations water levels can lead to changes in water quality. For example, saltwater encroachment may occur in coastal aquifers where pumping reverses the hydraulic gradients resulting in increasing dissolved mineral concentrations. This has occurred in a number of coastal wells resulting in increasing salinity above drinking standards which is detrimental to groundwater quality.

Water level changes in wells are driven by the interplay between groundwater recharge and discharge to and from aquifers. In general, water levels in wells decline due to increased groundwater withdrawal and/or reduced aquifer recharge. Conversely, limited groundwater discharge, a decrease in groundwater discharge, and/or increased aquifer recharge causes water levels in wells to rise. There are two situations to consider.

Unconfined (water-table) aquifers

In water-table aquifers, water levels in wells are direct indicators of the amount of groundwater stored in an aquifer at a given time.

Well water levels are constantly changing both in the short term and over the long term. Water levels fluctuate in response to changes in the quantity of water stored in that particular area of the aquifer. When the quantity of groundwater in an aquifer increases, water levels in wells rise. When the quantity of groundwater in an aquifer decreases, water levels in wells decline.

Confined aquifers

Changes in water levels in confined aquifers are not necessarily correlated to changes in aquifer storage. This is because confined aquifers respond to pumping in a different way from unconfined aquifers. In unconfined aquifers, dewatering of the formerly saturated space between grains or in cracks results in significant volumes of water being released. On the other hand, pumping in confined aquifers causes a decrease in water pressure – as opposed to a drop in water volume – in the aquifer near the pumping well. Within a confined aquifer, as pressure is reduced, the aquifer material compresses, porosity decreases, and the amount of water stored declines. The water levels in wells will drop somewhat but the entire thickness of the aquifer will remain saturated during pumping.

For additional information on changes in your water well level, contact your local Groundwater Conservation District (GCD) representative at http://www.texasgroundwater.org/.

For additional Frequently Asked Questions (FAQs) related to groundwater quantity, groundwater quality, septic systems, water wells, administrative entities, and publications, visit the Texas Groundwater Protection Committee's FAQ webpage at http://tgpc.state.tx.us/frequently-asked-questions-faqs/.