

Category: Water Quantity

Indicator: Trends in Aquifer Level

Methodology

Trends in Aquifer Level is an indicator of change in water levels in Texas aquifers over time. It evaluates any trend in aquifer levels over two time periods (2000 to present and full period of record) in monitoring wells for each of the nine major and twenty-one minor aquifers. This indicator is calculated by testing monitoring wells for significant trends using the Mann-Kendall trend test and is summarized to the county and aquifer levels as the percent of wells with increasing, decreasing or no trend in well level changes.

We used data on water levels in monitoring wells from the Texas Water Development Board's (TWDB) groundwater database. We did not utilize other datasets (e.g., US Geological Survey, groundwater conservation districts) unless they are included in TWDB's database. For the 2000 to present time period, all wells with at least 8 years of level measurements since 2000 were included. For the whole period analysis, wells were selected somewhat differently across aquifers to result in a manageable set of wells for analysis. We made selection to include as many wells as possible that have recent measurements while also incorporating wells with the longest historical period of record and to ensure that wells are spatially distributed throughout the spatial extent of each aquifer. We selected wells by the thresholds for most recent data available for the well and for a minimum number of years with data. Table 1 shows these selection criteria and the number of wells for analysis in each major aquifer. The criterion for all minor aquifers was: a most recent year of data of 2010 and a 10 year minimum number of years with data.

Table 1. Criteria for selection of wells for Trend in Aquifer Level analysis of major aquifers.

Major Aquifer	Most recent data	Minimum # of years with data	#Wells
Ogallala	2012	25	1740
Edwards-Trinity	2010	10	217
Carrizo-Wilcox	2010	15	390
Edwards (BFZ)	2011	15	68
Gulf Coast	2011	15	861
Hueco-Mesilla Bolson	2011	15	59
Pecos Valley	2011	15	68
Seymour	2011	15	55
Trinity	2011	15	298
Total			131,343

We calculated annual average water levels for each well to yield a single groundwater measurement for each year in the period of record for that well and ran the Mann-Kendall trend test on these averages. This test is a non-parametric test that determines whether a time series of data exhibits an increasing or decreasing trend and reports a level of significance. We considered the test significant with a p-value of less than 0.05. We used the Mann-Kendal

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results to determine if each well has an increasing, decreasing, or no trend for each of the two periods of analysis. Maps of wells analyzed for each aquifer are included in the web viewer and include the results of this trend analysis for both periods.

We then summarized these results to the aquifer and county level by calculating the percentage of all wells in each aquifer and each county within aquifer with increasing, decreasing, or no trend. Maps of aquifers and counties are included in the web viewer with the results of this analysis.

Data Sources

Texas Water Development Board. Groundwater Database. Accessed August 14, 2014.
<http://www.twdb.texas.gov/groundwater/data/gwdbbrpt.asp>

Texas Water Development Board. Major Aquifers shapefile. Modified by TNC to eliminate overlap of aquifer polygons. <http://www.twdb.state.tx.us/mapping/gisdata.asp>

Texas Water Development Board. Minor Aquifers shapefile. Modified by TNC to unify aquifer polygons and to add ID codes for each aquifer. <http://www.twdb.state.tx.us/mapping/gisdata.asp>