Groundwater Level and Storage Changes – Regions of New Mexico

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Stacy Timmons manages the Aquifer Mapping Program at the New Mexico Bureau of Geology and Mineral Resources at New Mexico Tech, in Socorro. Working with the Aquifer Mapping Program, she has been involved with several large-scale, long-term hydrogeologic studies focused on geologic influences on recharge, and groundwater movement and occurrence. Stacy has worked in diverse locations over New Mexico, including the San Agustin Plains, Magdalena, northeastern Tularosa Basin, Truth or Consequences hot springs district, La Cienega wetlands, and southern Sacramento Mountains. She has managed the Aquifer Mapping Program since 2013. This program aims to combine geologic, hydrologic, geochemical, and geophysical data to develop regional conceptual models to describe groundwater flow within aquifers in New Mexico. This work serves the state of New Mexico by providing publicly available reports and data that can be applied to decision-making and water resource planning. Stacy has BS and MS degrees in geology and has worked in hydrogeology for the Bureau of Geology since 2004. Prior to working at the Bureau of Geology, Stacy worked in environmental, groundwater, and surface water consulting in New Mexico.

Description of Project

Changes in water levels can reflect very relevant water issues in the arid southwest, such as variations in nearby surface water, fluctuations in recharge, and changes in the ground water storage (Figure 1). For this study, we will compile water level data, in an effort to begin development of a statewide water level change contour map. We will develop maps showing contours of changes in water levels within several select basins. Additionally, we will also attempt to quantify the change in ground water storage.

The proposed work will highlight changes in water levels on a regional scale, while in some regions it will highlight data gaps where future work is needed. In many regions of New Mexico, we know that water levels are declining, but the data have not been compiled to address the amount of decline in specific areas.

Project deliverables will show changes in ground water systems, which will give the results visual impact useful for illustrating the potential impact of conservation efforts and other water management options. With up-to-date regional maps showing contoured changes in water levels (time interval depending on the available data), the state of New Mexico will have a useful tool to aid in planning for future water management needs.

Methodology

For this project we are developing a statewide water level database. Data will be compiled from multiple agencies, reviewed and filtered toward the goals of this study. We will incorporate all data into one simplified water level database that can be used by other research groups or interested public entities. This will be completed by December 31, 2014.

From this database, starting in January 2015, regional contour maps of water level changes will be developed for selected basins. We are using a regional analysis approach because water level measurements have been collected over portions of the state, often clustered in areas with greater populations. Additionally, water level measurements have been collected at various time intervals, such as annual or 5-year intervals of measurement.

The water level measurements will be processed to calculate changes in ground water levels over the intervals relevant within a region, and then contoured using ArcGIS. Changes in aquifer water levels relate to changes in aquifer storage. Storage changes can be estimated using the changed volume of an aquifer (based on water level changes) and the storage property (specific yield) of the aquifer. With regional maps of water level

change, using ArcGIS, these surfaces can be paired with an average specific storage value applied to the region to estimate changes in groundwater storage (McGuire, 2013). From these results, the state of New Mexico will have a useful tool to aid in planning for future water management needs.

Results to Date

At this time, we have prepared a comprehensive database in MS Access that is based on site locations (Figure 2). The bulk of the data is from the USGS, New Mexico Office of the State Engineer (NMOSE), and New Mexico Bureau of Geology & Mineral Resources (NMBGMR), which now includes about 5400 well locations and over 130,000 water level measurements. These measurements include sites that have been measured periodically since the 1940s. We have provided this data to the Statewide Spatiotemporal Water Level project to insure common data are being used between the two water level projects. As water level measurements continue in the state, we will continue to incorporate data into this database, from which we can provide data to other research groups or interested public entities.

Remaining work includes providing a simplified database of well locations and water levels, with queries built for analysis of water level changes over available date ranges for deliverable by December 31, 2014. Also in December 2014, we are meeting to discuss selection of regions to address. By June 2015, we will complete contouring of water level changes for selected regions and attempt calculations of changes in ground water storage.

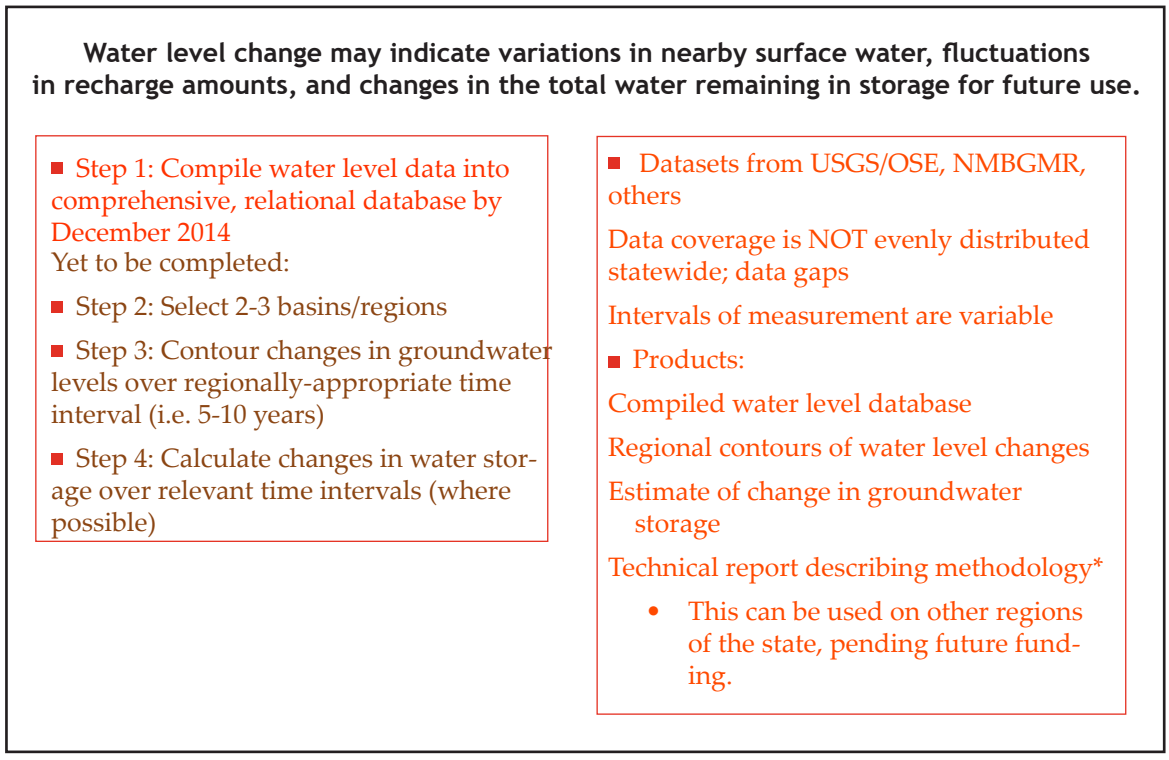

Figure 1. Groundwater level and storage changes for regions of New Mexico. Stacy Timmons, NMBGMR; Mike Johnson, NMOSE; Nathan Myers, USGS; Matt Ely, USGS; KC Carroll, NMSU.

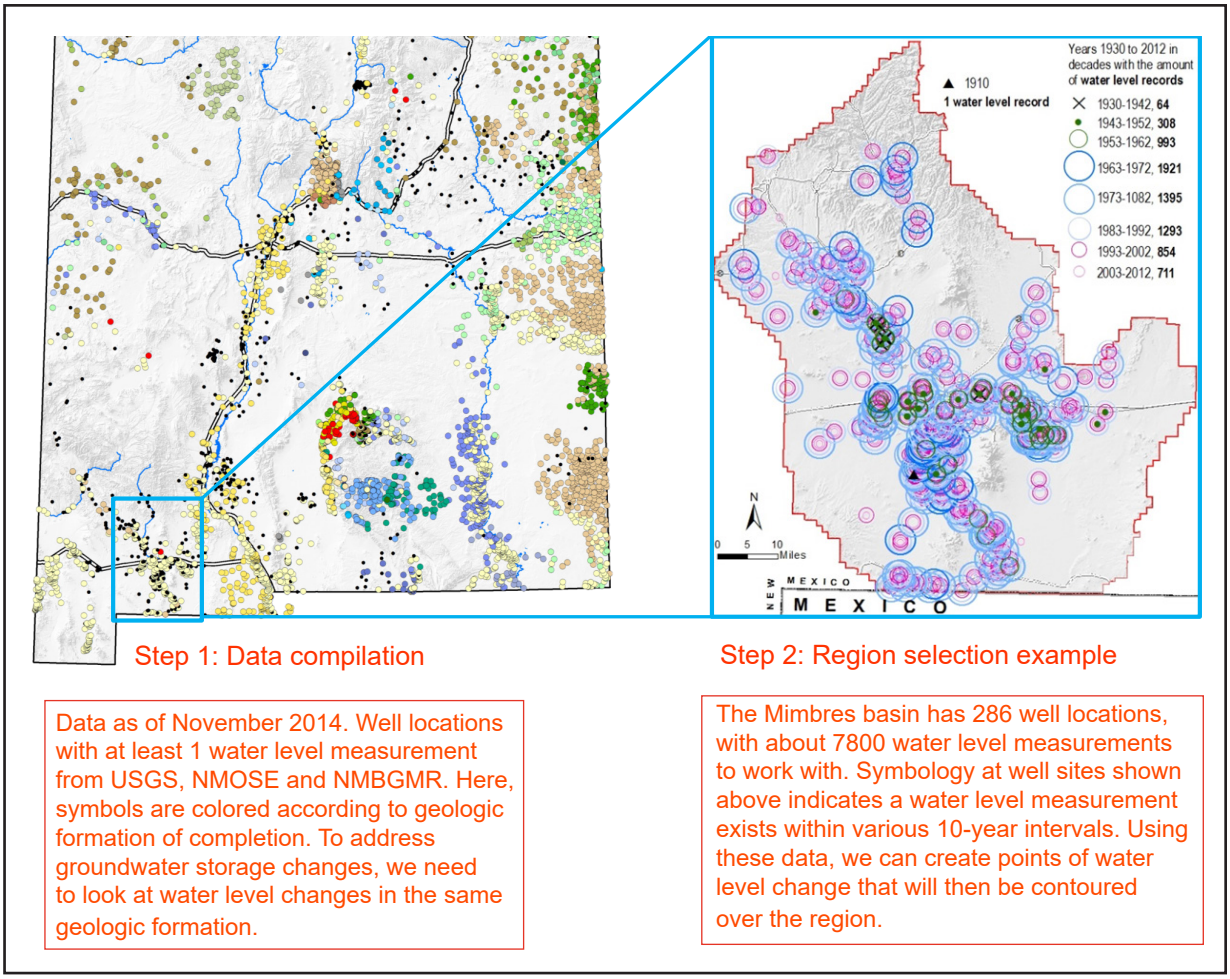

Figure 2. Groundwater level and storage changes for regions of New Mexico. Stacy Timmons, NMBGMR; Mike Johnson, NMOSE; Nathan Myers, USGS; Matt Ely, USGS; KC Carroll, NMSU (cont.).

Investigators

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References

McGuire, V.L., 2013, Water-level and storage hanges in the High Plains aquifer, predevelopment to 2011 and 2009–11: U.S. Geological Survey Scientific Investigations Report 2012–5291, 15 p. (Also available at http://pubs.usgs.gov/sir/2012/5291/.)