
Groundwater level and storage changes – Regions of New Mexico

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Statement of Critical Water Resource Problem

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. For this study, we have compiled 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.

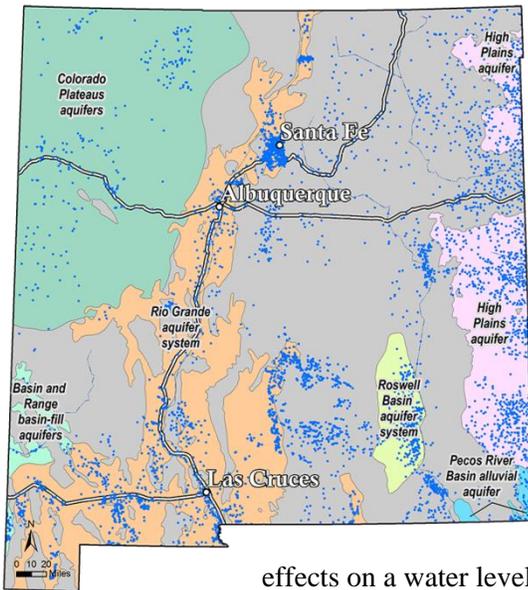
This work will highlight changes in water levels on a regional scale, while in some regions it will highlight data gaps where future work is needed. In many regions of New Mexico, we know that water levels are declining, but the data have not been compiled to address the amount of decline in specific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

This midterm report summarizes the data compilation phase of this statewide project as of December 2014. The remaining analysis of groundwater level changes, contouring and calculation of groundwater storage changes is underway and will be completed by June 2015.

Statewide Groundwater Level Monitoring Data

Groundwater levels are measured in wells around the state by multiple agencies and groups, at various intervals and over various time scales. The following map shows locations of wells with multiple water level measurements. The most comprehensive, long-term groundwater level monitoring network, the NM

Groundwater Data Program, is maintained in cooperation with the NM Office of the State Engineer and the US Geological Survey (USGS) New Mexico Water Science Center. Historical records of water level measurements beginning in the early 1900s, measured by the USGS, provide a long-term record of water level changes.



The monitoring networks in New Mexico are primarily composed of wells with other purposes, and they are not designated monitoring or observation wells. Water levels can be measured in many types of wells including domestic, irrigation, or public supply wells, for example. Data quality can be variable considering the other uses of the well. For instance, if a well is pumping or has been pumped just before measurements, it may not be representative of the true static water level. Data are maintained to describe the uses and construction of the wells, as well as the possible

effects on a water level measurement at the time when it was measured. These data have been included in this midterm deliverable and the efforts of compiling data are described below.

The Aquifer Mapping Database

Since 2007, New Mexico Bureau of Geology and Mineral Resources (NMBGMR) has been developing and maintaining a relational database of water information that includes water levels, well information, and aquifer hydraulic properties, among other things. This comprehensive, MS Access database, called the Aquifer Mapping Database (AMD), incorporates data from recent hydrogeology studies of the NMBGMR, including well and subsurface geologic data. Building upon the existing AMD for this WRII statewide water level assessment, we have incorporated datasets from multiple agencies including the USGS, NMOSE, and other regional water level monitoring networks.

For this project, we incorporated two data retrievals from the USGS database, which has historic water level measurements across NM, and the recent NM Groundwater Data Program measurements. These retrievals were in the format of MS Excel worksheets with tabs separating well site locations, well information, and water level measurements. All records were cross-referenced by the USGS Site ID number. The first retrieval included all well points that are currently within the monitoring network. The current monitoring network was reconfigured in 2006 to provide better coverage over the state. The second dataset included the wells that had historical measurements prior to the 2006 reconfiguration. The USGS filtered these data to include only wells that had measurements for at least three rounds of measurement, at a frequency of annually and/or every 5 years.

Groundwater level measurements were also contributed from Bernalillo County Public Works monitoring network which began in 2010. These data were also delivered in MS Excel worksheets.

USGS Data Processing by NMBGMR

To begin processing the data for input into the AMD, duplicate sites were removed from the well locations. In the first data retrieval, there were 1,952 site records, but after duplicates were removed there

were 1,835 records imported into the AMD. Most USGS sites were provided with decimal degrees, which we converted to UTM coordinates in Zone 13. For those sites where the location is actually in UTM Zone 12, we projected the coordinates into Zone 13 for the database. These first retrieval site locations had 31,940 associated water level measurements, which we imported into the AMD. The second data retrieval from the USGS included 2,388 new site locations, of which 345 were site duplicates, so a total of 2,043 new site locations were imported into the AMD. For both datasets from the USGS, we performed ArcGIS and site ID location checks to prevent duplication of sites within the database. With the second data retrieval from the USGS, there were 88 sites that overlapped with sites existing in the AMD. Those sites were left unchanged in the AMD. The second data retrieval had 65,193 water level measurement records associated with site locations that were imported to the AMD.

Bernalillo County Data Processing by NMBGMR

The MS Excel spreadsheet delivered from Bernalillo County included worksheets of well locations and water levels. There were 194 locations in the dataset and 1,432 water level records. Two locations within the dataset did not have corresponding water levels. Coordinates for the Bernalillo County data were in NAD83 HARN State Plane in feet. These coordinates were converted to NAD83 UTM Zone 13 for consistency within our database.

Of the 1,432 water level measurements, 62 were removed as they were events where the well was visited, but not measured due to various reasons such as equipment failure, locked gates, etc. A total of 1,370 water level measurements were added to the AMD.

We added a data quality field to the Bernalillo County dataset. Where an acoustic sounder was used to determine the depth to water, we designated a data quality level of “2,” which indicates that the data are considered “fair” quality, and that the measurement is repeatable (approximately within one-foot of previous measurements). The imported airline measurements, readings from pressure transducers, steel tapes and electronic tape were designated a data quality level of “1,” which suggests a “good” quality water level measurement that is repeatable (within 1/10th of a foot). Essentially, these data quality fields were added to distinguish the lower data quality of acoustic sounder measurements.

Statewide Water Levels Database

All data from the AMD were compiled with the USGS and Bernalillo County datasets. Once these data were reviewed, filtered and added to the database (as described above), a smaller, more streamlined database was developed to share these data, as per this WRRRI contract deliverable. This smaller database, called “Statewide Water Level Database” (SWLD) was produced for this contract deliverable.

All well site locations and basic well construction information, including well depth and the water producing geologic formation (if interpreted), are compiled in a “Location” table. There are a total of 5,412 location records in this current database. In order for the MS Access database to function properly, the time-series water level data for all well location is stored in a separate table and linked to the location table in a one-to-many relationship. This requires a ‘primary key’ field in the location table with a unique identifier assigned to each location. This field can have no duplicates and no blanks, and in the SWLD has been named “Point ID.”

The “PointID” field includes NMBGMR inventoried well sites from various local hydrogeology projects. The two-letter prefixes on these PointIDs specify a particular project, as listed in the table called “Projects.” All sites associated with the USGS dataset have a USGS ID field, and have “NM” as the two-letter prefix for the “PointID” field. All locations are in UTM NAD83 coordinates, all fit to locate within Zone 13 (“EastZn13”; “NorthZn13”). Also within the Location table are the site elevations in feet (column heading “altitude”), interpreted from various sources such as DEMs and topo maps. If it was available, the drill hole (“HoleDpthFtBGS”) and well depth (“WellDpthFtBGS”) was included, in feet below ground surface. The geologic formation of water production (interpreted) was also included in the “Formation” column. The codes associated with this field are described in the lookup table “LU_Formations.”

All water level measurements (current total 131,233 records) are within the “WaterLevels” table, which is related to the Location table by the PointID field. Included in this table are the dates of water level measurements and the depth to water, in feet below ground surface (“DepthtoWater_bgs”). The “LevelStatus” field includes a code that describes any possible effects on the water level measurement. These are described in the associated table called “LU_Level Status.” The “MeasurementMethod” field indicates the technique used to measure the water level, and is described in the “LU_MeasurementMethod” table. The “DataQuality” field is not always populated, but is intended to provide a level of confidence in the measurement, as described in the table called “LU_DataQuality.” The “DataSource” codes are explained in the “LU_Depth/CompletionSource” table, and the “MeasureAgency” column attempts to further refine the source of the dataset, as described in “LU_MeasuringAgency.” All USGS measurements provided in the data retrieval are indicated in the MeasureAgency field as “USGS,” and Bernalillo County as “Bernalillo Cty.”

We have included two functional queries to help assess data. One is listed under queries called "MaxWLDDateDTW" and it provides all points with their most recent water level measurement only. The second is shown by a form, which was built to run a query to get water levels from a beginning time and an end time, to calculate the change and compare water levels. When you open the database, this form comes right up. These two queries are built upon multiple other queries. Changing the existing queries could adversely affect these two functional queries.

One final note on the function of this database is that in order for this database to continue to operate as an “.mdb” file, and work with ArcGIS, it is important to set options under “File/Options/General” for “Default file format for Blank Database” to “Access 2002-2003.”

In summary, this SWLD is a subset of data included in the AMD, and for further information on these measurements or other available data, please contact Stacy Timmons at NMBGMR, or Nathan Meyers at USGS, using contact information provide above. This midterm report summarizes the data compilation phase of this statewide project as of December 2014. It is important to keep in mind that data are continuously collected, so this database will need to be periodically updated in order to reflect new, updated measurements.