November 2019

Sunshine Valley Hydrogeology Study

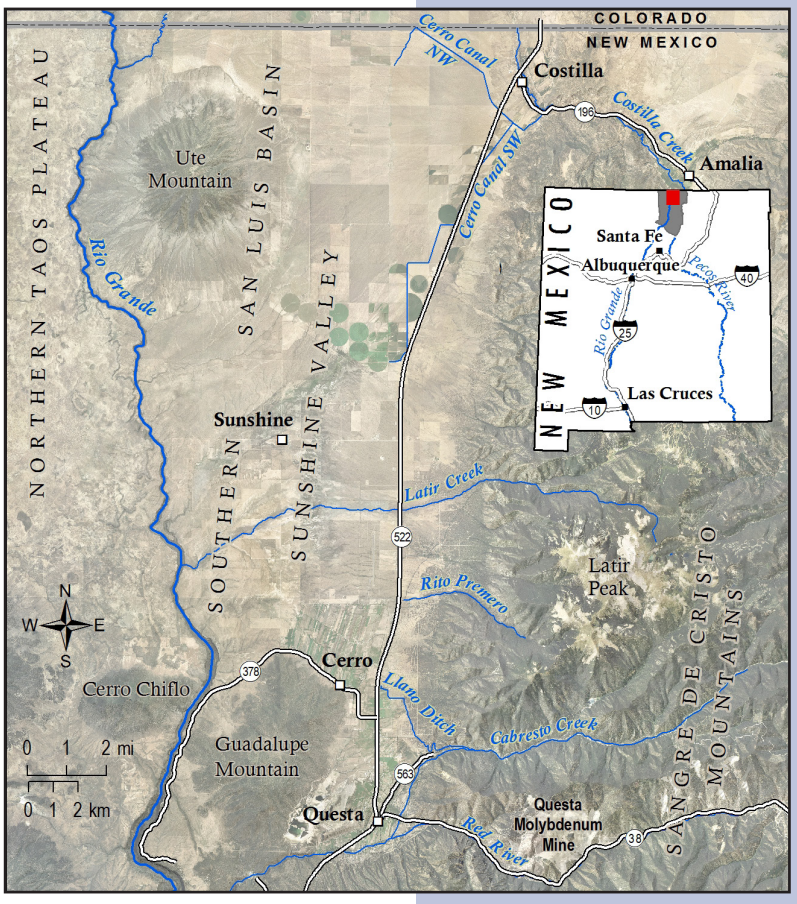
MAJOR FINDINGS

The New Mexico Bureau of Geology and Mineral Resources (NMBGMR) has recently completed a study on the hydrogeology of Sunshine Valley. The aquifer beneath Sunshine Valley consists of layers of sand, gravel, and lava flows. The groundwater in the aquifer is recharged by precipitation that falls on the Sangre de Cristo Mountains. The precipitation becomes groundwater that moves west from the mountains into the valley aquifer. Infiltration of streamflow and irrigation water also recharges the aquifer. This study has shown that it takes at least 60 years for groundwater to move from recharge areas, through the Sunshine Valley aquifer, to the springs in the Rio Grande and Red River gorges. The results are also in agreement with previous work that estimates that 1,000 to 3,000 acre-feet of water has been removed from storage in the aquifer since the 1980s. The loss of water in storage can be seen in groundwater levels, which have trended slowly downwards since the 1980s. The most likely causes for the loss of groundwater are increased diversion of surface water for irrigation combined with decreases in precipitation and streamflow, and increases in mean annual air temperature.

BACKGROUND

The Sunshine Valley is east of the Rio Grande and west of the Sangre de Cristo Mountains in Taos County in northern New Mexico. The regional significance of the groundwater and surface water interactions in this area is an integral piece of the Aamodt Settlement Agreement. This agreement includes the sale and conversion of 1,752 acre-feet of groundwater rights from Sunshine Valley to surface water rights downstream on the Rio Grande. The reasoning is that groundwater not pumped for consumptive use (i.e., irrigation) in Sunshine Valley could ultimately be available as surface water downstream on the Rio Grande.

With these facts in mind, the Aquifer Mapping Program at the NMBGMR conducted a study of the hydrogeology of Sunshine Valley. We measured static groundwater levels in numerous wells, collected groundwater and surface water samples, and analyzed them for chemical constituents and the naturally occurring environmental tracers tritium (^{3}H) and carbon-14 (^{14}C). We measured temperature-depth profiles in several open, unused wells, and used geophysical surveys to map the depth of the aquifer in the central portion of the valley. Historical water-level and water-chemistry data from the NMBGMR, the U.S. Geological Survey (USGS), and Taos Soil and Water Conservation District (Taos SWCD) were also tabulated and interpreted. These new data were combined with inferences from geologic maps, well drillers' logs, previous scientific and engineering reports, streamflow data from the USGS, and estimates of surface water and groundwater use from the New Mexico



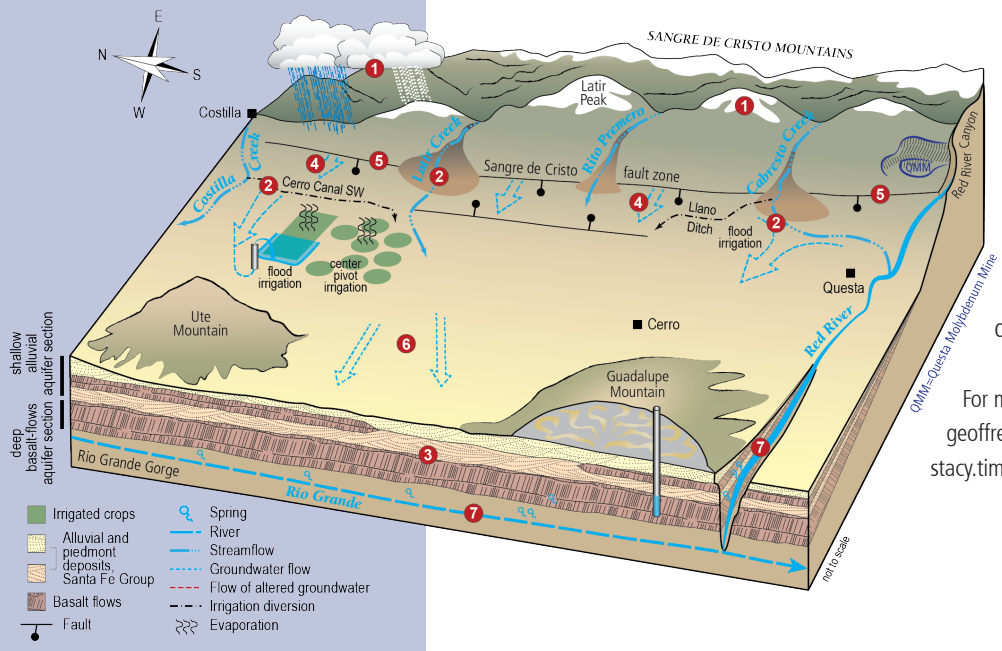
Location map of the study area in northern Taos County, New Mexico (inset).

AQUIFER MAPPING PROGRAM

Office of the State Engineer (NMOSE) to create a conceptual model of the hydrogeology of Sunshine Valley and to calculate a water budget. A water budget compares the recharge to and discharge from an aquifer. Just like a bank account, if recharge (the deposits) equals discharge (the withdrawals) the storage of water in the aquifer (the account balance) is stable over time. Calculation of a water budget is challenging due to the geologic complexity of natural aquifers and the necessity of estimating recharge and discharge from data that is often sparse and/or variable in quality.

In addition to characterizing the hydrogeology of the region, important results from this study indicate that:

- Groundwater quality in this region is very good.
- Recharge to the aquifer in this region occurs rapidly via vertical downward flow though the aquifer. Faults along the mountain front provide pathways for recharge water to move relatively quickly into deep levels of the aquifer.
- The dominant source of recharge is winter precipitation.
- Based on age measurements of sampled groundwater, we found that most water discharging at springs in the Rio Grande Gorge has taken more than 60 years to travel from the area of recharge.
- Repeated groundwater-level measurements in wells show a general decline in water levels since the 1980s, and we estimate that even with the abundant recharge, 1,000 to 3,000 acre-feet of water has been lost from storage annually since the 1980s.
- We located several wells southwest of Costilla with elevated groundwater temperatures.
- Using geophysical surveying methods in central Sunshine Valley, we located groundwater in the subsurface. These methods may be useful for mapping the occurrence of groundwater throughout the valley.



Numbered circles on the diagram correspond to main concepts of the hydrogeology of Sunshine Valley. 1—Recharge to the aquifer is derived from high-elevation winter precipitation. 2—Surface water enters the aquifer via infiltrating streams and irrigation. 3—The aquifer consists of interbedded sediments and basalt lava flows. 4—Groundwater also moves into the aquifer from the mountains. 5—Recharging water infiltrates to several hundreds of feet in the northern valley, probably along faults. 6—Groundwater moves west through the aquifer. 7—Groundwater discharges to the Rio Grande and Red River via springs and seepage.

The basic geology of the Sunshine Valley aquifer is similar to that found west of the Rio Grande on the northern Taos Plateau and in the south Taos Valley north of the Picuris Mountains. However, Sunshine Valley is notable for its high-quality water and abundant recharge, which moves quickly into the aquifer.

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New Mexico Bureau of Geology and Mineral Resources
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We are a non-regulatory governmental agency (the state's geological survey) that conducts scientific investigations leading to responsible development of the state's mineral, water, and energy resources.

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