Hydrogeology and Water Budget of the Sunshine Valley Region, Taos County, New Mexico

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It has been known since the 1920s that there is significant influx of groundwater to the Rio Grande in the reach that bounds the western edge of Sunshine Valley in northern Taos County, New Mexico. This occurs as spring discharge and seepage. The recent Aamodt Settlement Agreement includes a clause stating that 1,752 acre-feet per year of groundwater rights used for irrigation in Sunshine Valley are to be transferred to the Nambe–Pojoaque–Tesuque basin as surface water to be diverted from the Rio Grande. The reasoning is that groundwater not pumped for consumptive use will be available as surface water downstream. Thus this remote, sparsely populated region is of great regional hydrologic significance.

The Sunshine Valley aquifer consists of sand and gravel layers overlying and interbedded with fractured and highly transmissive basalt flows that pinch out to the east. Low-permeability, clay-rich lake deposits in the central valley cause local semi-perched and semi-artesian conditions. Recharge originates largely as winter precipitation in the Sangre de Cristo Mountains to the east of the valley; little recharge occurs across the valley floor. More than half of the recharge moves laterally into the aquifer from the adjacent mountain block, resulting in locally elevated groundwater discharge temperatures and perturbed thermal profiles in wells near young range-front faults. The remaining recharge occurs as infiltration of streamflow and irrigation water derived from streamflow. The very steep range front and extreme relief from the valley floor to the adjacent peaks, recently-active range-front faults, and abundant faults, fractures, and hydrothermal alteration in the mountain block associated with the Questa Caldera all likely play a role in the large amount of lateral ground water movement into the aquifer.

Water budget calculations for the region are constrained by fundamental data limitations, yet they imply that the valley aquifer is approximately in equilibrium, with estimated discharges falling between the estimated upper and lower bounds of recharge. Storage changes calculated from sequential water-level elevation surfaces indicate average storage losses of 1000 – 2000 acre-feet per year since the 1980s, corresponding to average water-level declines of few feet per year.

Cessation of groundwater pumping due to the water-rights transfer will ultimately result in additional discharge to the Rio Grande and Red River on a time scale of a few to several tens of years. Regional trends in precipitation, temperature, and surface water-use are the most likely factors involved in the declining amount of water in storage in the Sunshine Valley aquifer. Continued declines in annual precipitation and streamflow and increases in mean annual temperature will decrease the amount of recharge to and discharge from Sunshine Valley.

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