Multi-component geochemical characterization to support hydrologic modeling in an urban aquifer system, Fountain Creek alluvial aquifer, El Paso County, Colorado

CONNOR P. NEWMAN[1]*, EMILY A. BAKER[1], SUZANNE S. PASCHKE[1], ZACHARY D. KISFALUSI[1]

[1]US Geological Survey, Colorado Water Science Center, PO Box 25046, Denver Federal Center, Denver, Colorado, USA, 80225; *correspondence: cpnewman@usgs.gov

The Fountain Creek alluvial aquifer system located in south-central Colorado, USA, partially supports the growing Colorado Springs metropolitan area, and is the source of domestic and irrigation water for communities in the basin.To facilitate a coupled understanding of hydrologic and geochemical processes, an extensive geochemical dataset was collected to inform groundwater/surface-water interactions, sources of dissolved solutes, groundwater-mixing relationships, and groundwater-recharge processes. Following conceptualization using geochemical data, a numerical groundwater-flow model was built to simulate flow in the alluvial aquifer and exchange with surface waters.

Analysis of geochemical data indicates there are three distinct groundwater geochemical zones, which are geographically related to proximity to surface water. Data for rare earth elements (REE) illustrate leakage of waste-water treatment plant (WWTP) effluent from Fountain Creek to the alluvial aquifer based on gadolinium (Gd) anomaly. A principal component analysis (PCA) agrees with REE and major-ion data and reveals the importance of groundwater/surface-water exchange, in addition to mixing of groundwaters of variable residence times.

All groundwater samples contain appreciable tritium (^{3}H) indicating the presence of modern recharge. Noble-gas isotopes, sulfur hexafluoride (SF_6) and ^{3}H concentrations indicate that groundwater residence times vary substantially within the aquifer, with a zone of longer residence times in the central zone of the flow system between the active recharge zone and the discharge/recharge zone near Fountain Creek.

Numerical groundwater-flow modeling incorporates the recharge/discharge zones identified by geochemical analyses combined with results of aquifer tests and potentiometric-surface monitoring.