

APPLICATION OF THE NORTHERN ARIZONA GROUNDWATER FLOW MODEL
(NARGFM) TO THE UPPER VERDE RIVER - POTENTIAL FUTURE DECLINES DUE
TO ADDITIONAL GROUNDWATER EXTRACTION

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ABSTRACT

The work discussed in this paper was carried out to study (A) the accuracy and predictive capability of the U.S. Geological Survey (USGS) Northern Arizona Regional Groundwater-Flow model (NARGFM) within the Big Chino, Little Chino, and Verde sub-basins; (B) illustrate historical change in base flow at the USGS Paulden and Clarkdale streamgages; and (C) perform forward-looking simulations for the period 2005-2110 that evaluate potential effects on base flow in the upper Verde River resulting from (1) unchanged water demand from 2005 through 2110, (2) continuing drought, (3) increased water demand, (4) extraction of 12,000 acre-feet per year (ac-ft/yr) of groundwater from the central part of Big Chino Valley beginning in 2020, and (5) the cumulative effect of cases (1) through (4).

This report builds on earlier work by the USGS in cooperation with the Verde River Basin Partnership (VRBP) and the Town of Clarkdale that applied the NARGFM in a series of simulations to gain a greater understanding of the past and potential future human impacts on the Middle Verde River's streamflow.

Testing of NARGFM showed that excellent agreement was found between historically observed and simulated groundwater elevations within the area of concern. In addition, simulated trends in both groundwater elevation and discharge to the Verde River are accurate to within industry-standard ranges.

New simulations using NARGFM show that the cumulative effect of continuing drought, increased water demand, and extraction of 12,000 ac-ft/yr of groundwater from the Big Chino Valley indicates a loss of base flow to the Verde River at the Paulden streamgage of 14.7 cfs between 2005 and 2110. Inasmuch as the base flow at the Paulden streamgage in 2005 was ~19 cfs, this would leave only 4.3 cfs in the river at the streamgage by 2110.

Regional planning of water use within Yavapai County is needed now. Senators John McCain and Jeff Flake recently sent a letter to County officials urging them "to develop a long-term water management strategy that protects the Verde River". In a similar

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vein, this paper independently uses the NARGFM in a forward-looking manner to explore the potential effects of continued and increased groundwater extraction on base flow to the Upper Verde River and nearby water wells. The results demonstrate that significant decreases are expected and that regional planning is needed to address the future water supply for Yavapai County.