



Verde Watershed

CURRENTS

V E R D E W A T E R S H E D A S S O C I A T I O N

“Base flow in middle Verde River area is critical to maintaining the river’s support of the aquatic life, riparian habitat, non-aquatic wildlife, and human needs supplied by the current river system. Development of strategies to mitigate potential loss of base flow requires, first and foremost, understanding of how the system currently operates. The newly funded USGS-VRBP geophysical study represents a critical step toward achieving that objective.”

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VRBP AND USGS RECEIVE GRANT FOR STUDY OF SHALLOW VERDE RIVER AQUIFER SYSTEM

Introduction

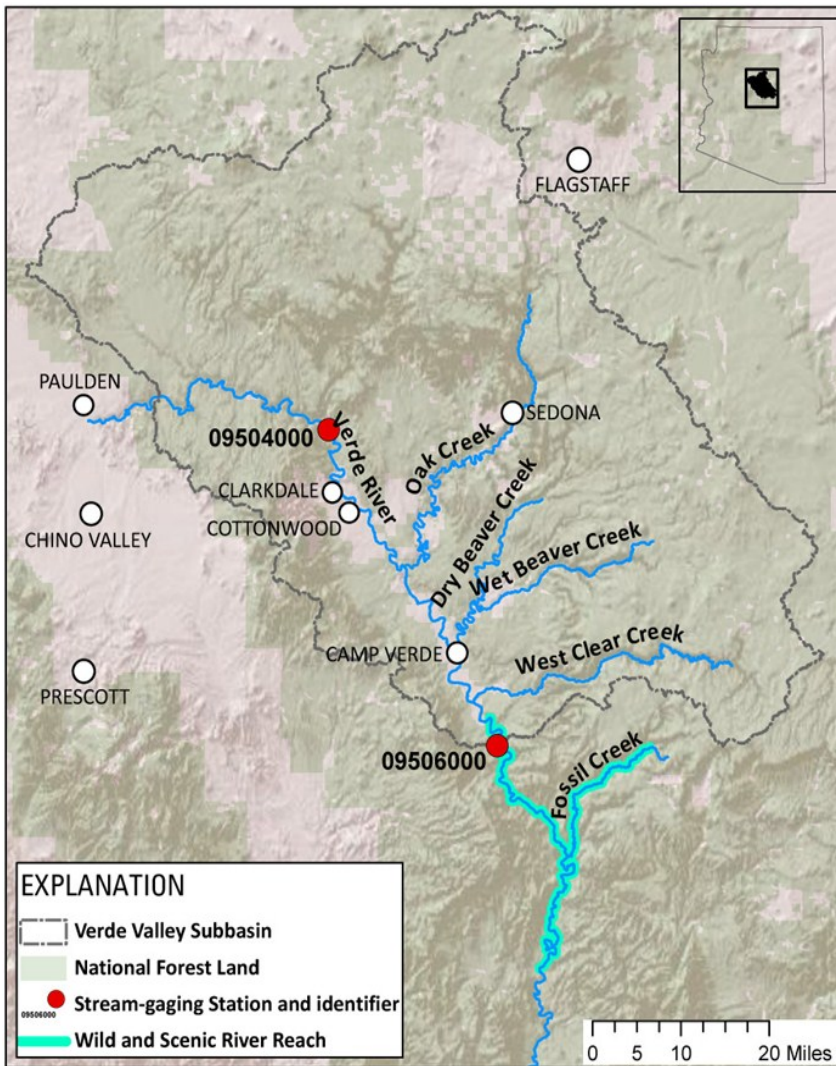
The Verde River Basin Partnership (VRBP) and the U.S. Geological Survey (USGS) have been awarded a \$75,000 grant by the Yavapai County Resource Assessment Committee under the authorization of the Secure Rural Schools and Communities Self-Determination Act of 2000, as re-authorized in 2008. The grant supports a USGS investigation entitled Investigation/Monitoring of Hydrogeologic Properties of the Shallow Aquifer System along the Verde River, Verde Valley, Arizona.

The total project budget is \$99,345 over 18 months. The budget represents a net of \$71,250 (after deduction of a 5 percent Forest Service management fee) plus commitment of \$28,095 in USGS Cooperative Water Program funds. The Town of Clarkdale has graciously agreed to serve as the local governmental cooperator. The Town will administer the grant by receiving the newly-awarded Yavapai County Resource Assessment Committee funds, paying the USGS, and carrying out the accounting and verification that the grant requires.

The project was designed collaboratively by the Verde River Basin Partnership and the USGS. The planned field work is an electrical-geophysics survey by the USGS along the length of the Verde River between the USGS streamflow-gaging stations near Clarkdale (number 09504000) and Camp Verde (09506000) (fig. 1) where access is feasible. The USGS will analyze the results and publish an interpretive USGS-Series report.

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Background



The hydrologic system of the Verde Valley involves complex and incompletely understood interactions among streamflow, regional groundwater, and shallow groundwater supplied by infiltration from irrigation and irrigation ditches. Verde River base flow in the Verde Valley, as well as in downstream reaches that include the Wild and Scenic Reach (fig. 1), which is managed by the Forest Service, depends on inputs from upstream areas, gains from the regional aquifer, and return flows from infiltrated irrigation water as well as direct surface-water return flows from irrigation diversions. Critical to these interactions is the ever-increasing demand for additional water resources throughout the Verde watershed in Yavapai County. Such demand has the potential to further reduce base flow in the Verde River and its tributaries. Diminished flow during the irrigation season could substantially degrade the river's support of the aquatic life, riparian habitat, non-aquatic wildlife, and human needs supplied by the current river system. Diminished flows also threaten the diversion-based irrigation that is the lifeblood of both agriculture and the rural/suburban lifestyle along the Verde and its perennial tributaries in the Verde Valley.

Figure 1. Map of study area.

Collaborative groups such as the VRBP and the Yavapai County Water Advisory Committee (WAC) are developing information and tools to support the best possible decisions by elected officials, public-lands managers, and water managers about actions that affect the river. Critical among these tools is the northern Arizona regional groundwater-flow model that was developed with funding from WAC, USGS, and the Arizona Department of Water Resources. Acquisition of additional knowledge for model refinement is an on-going need to increase certainty in decision making. An important step to improve the accuracy and utility of the regional groundwater-flow model within the Verde Valley is clarification of the hydrologic connection to both the underlying regional aquifer and the river itself of the shallow aquifer that is adjacent to the river and is supplied by water from irrigation diversions.

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The Problem

Work by the USGS in developing the regional groundwater-flow model showed that water-levels in at least some shallow wells near the river rise as river flow decreases and fall as river flow increases. Neither the exact timing of the water-level changes nor the reasons for this inverse correlation is well understood, but they highlight the need for improved understanding of stream-aquifer interactions. The hydrogeology of the shallow aquifer, comprised of the stream alluvium along the Verde River, and its interaction with the upper part of the regional aquifer, comprised of the Verde Formation, are poorly understood. Diversions for irrigation and the processes of surface-water and groundwater returns to the river represent a major human-induced change to the natural system, and their interactions with the aquifer system are likewise poorly understood. Thus the current groundwater-flow model does not explicitly simulate the diversion and return-flow processes owing, in part, to lack of data that could be used for calibration and constraint. Limits on the understanding of the interactions between the stream and the aquifer system hamper the model's ability to simulate details in the near-stream environment. From a management standpoint, insufficient understanding of the interactions of the diversions with the aquifer system and river flow in the Verde Valley prevents accurate assessment of ecological and water-resource implications of past and future resource development. A logical first step is collection of basic data needed to clarify stream-aquifer interactions via development of a quantitative understanding of the geometry and relative hydrogeologic properties of the shallow aquifer system adjacent to the river.

Approach

The USGS will use established electrical geophysical methods to gather information about the presence or absence and distribution of flow-limiting fine-grained sediments that would constrain vertical groundwater exchange between the relatively thin irrigated alluvial deposits near the river and the underlying Verde Formation, which forms the upper part of the regional aquifer near the river. The information will help characterize the lithology and thickness of the stream alluvium and the lithology of the uppermost part of the underlying Verde Formation (limestone, clay, or sand and gravel). Thus, it will provide critical basic information about both where groundwater exchange between the alluvial deposits and the underlying regional aquifer is active and where it is significantly limited. Well logs indicate that the thickness of the shallow alluvium is rarely greater than 50 feet, and the surveys will investigate 1.5 to 2 times that depth. Surveys will be run along the length of the Verde River between the USGS streamflow gages near Clarkdale and Camp Verde where access is feasible. Data collected away from the river on the flanking terraces is also valuable, but more difficult to obtain owing to requirements for access permission. Where reasonable, data will be collected by using terrace surveys. The information from the surveys will be used to support interpretation of the results from the current regional groundwater flow model and will also have direct application to the development and improvement of future groundwater-flow models.

Significance

Base flow in middle Verde River area is critical to maintaining the river's support of the aquatic life, riparian habitat, non-aquatic wildlife, and human needs supplied by the current river system. Important among these is the role of the diversion-based irrigation that is the lifeblood of both agriculture and the rural/suburban lifestyle along the Verde and its perennial tributaries in the Verde Valley. Development of strategies to mitigate potential loss of base flow requires, first and foremost, understanding of how the system currently operates. The newly funded USGS-VRBP geophysical study represents a critical step toward achieving that objective.

Prepared by Ed Wolfe

Yavapai County Water Advisory Committee (WAC) Update

Current Yavapai County Water Advisory Committee (WAC) priorities include the Central Yavapai Highlands Water Resource Management Study (CYHWRMS) with the Arizona Department of Water Resources (ADWR) and U.S. Bureau of Reclamation, and the Northern Arizona Regional Groundwater Flow Model recently released by the USGS. Additionally the WAC will be considering results of a Demand Analysis for a portion of the upper Agua Fria performed by Reclamation.

The CYHWRMS study team is continuing to define and analyze alternatives to meet unmet future water demands that were identified in earlier phases. A draft Phase 2 report that identifies potential sources of water to meet future demands is posted on the WAC website. The WAC website has additional information on the study in general and specific results of Phase 1 (<http://www.co.yavapai.az.us/Content.aspx?id=20562>). We anticipate that the alternative development phase will continue throughout 2011. The alternative evaluation criteria include environmental, economic, legal and institutional analyses as well as Reclamation's four tests-of-viability (completeness, effectiveness, efficiency and acceptability). The TWG typically meets on the first Thursday of each month at 10:30 following the meeting of the Technical Committee of the WAC.

The Model Report for the current USGS Northern Arizona Regional Groundwater Flow Model has been released and the WAC has received one general presentation from the USGS regarding model basics and the construction of this model. The TAC has had technical sessions with the USGS regarding the model and questions that have been raised regarding its construction and use. The model re-

port can be found on the USGS website (<http://pubs.usgs.gov/sir/2010/5180/>). The WAC anticipates continued effort to explore, utilize and possibly refine the model; and a lively discussion on how to direct future resources towards the model and its use.

The WAC will be receiving results of a simple demand analysis for a portion of the upper Agua Fria sub-basin in Yavapai County. Similar to Phase 1 of the CYHWRMS, the future population and water use has been estimated for Water Planning Areas in the study area. A report that details the methods and results is in preparation and will be available for public comment in November 2011. One of the objectives of the work is to evaluate the future demand estimates against estimates of supply in order to determine if areas of future need can be identified. Following discussions of the results, the WAC will consider if and how to pursue solutions and fund expenditures in the Agua Fria basin. Along with Reclamation, the Upper Agua Fria Watershed Partnership has been involved in the study.

Please contact the WAC Coordinator, John Rasmussen, for meeting dates, details on any of the WAC activities or if you would like to be added to the WAC email-recipient list (john.rasmussen@co.yavapai.az.us or 928-442-5199).

Prepared by John Rasmussen

VERDE WATERSHED WINTER OUTLOOK
LA NINA: PRECIPITATION LIKELY LESS THAN NORMAL

The Verde watershed experienced another dry monsoon, much like the summer of 2009-two years ago (last summer had near normal rainfall). The only exception to this year was September, where the Verde picked up quite a bit of rain around the middle of the month. In fact, many gauges nearly doubled their accumulated monsoon rainfall totals during this period. The Verde rainfall total for monsoon 2011 came in at 4.91 inches, which is below the 1981-2010 climatological average of 6.04 inches.

While precipitation during the summer of 2009 was similar to this year, there are substantial differences in what is expected this winter compared to the winter of 2010 (many of us still have vivid memories of the historic rain and snow events during January, 2010). Current climate indicators point to a winter that is more in line with last year (near normal Dec-Mar precipitation) or drier. One such indicator, La Niña, has reemerged this fall with forecast guidance indicating La Niña's continuation through at least spring. This has driven the seasonal outlooks released by the National Weather Service's Climate Prediction Center, which favor below normal precipitation for the Verde watershed (and most of Arizona) this winter.

Submitted by the Salt River Project

Membership Form for Verde Watershed Association

Government units	\$100 per year
Business for profit	\$100 per year
Civic groups and non-profits	\$50 per year
Individuals	\$25 per year

Make Checks Payable to:
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P.O. Box 4001
Cottonwood, AZ 86326

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E-mail address to receive the Verde Currents E-Newsletter:

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