Studies and Experts Agree:

Withdrawing Groundwater from the Big Chino Valley

Will Reduce Flow in the Verde River!

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The Issue

Independent experts have made the title statement "Withdrawing Groundwater from the Big Chino Valley Will Reduce Flow in the Verde River" on numerous occasions over many years. However, public officials with an interest in withdrawing groundwater from the Big Chino Valley and piping it to the Prescott region for new subdivisions have frequently rejected these expert determinations. Their rejections have not been accompanied by rigorous analysis and evaluation of the data. Given the prominent voices of public officials, it is easy to see why the public can be confused.

In this paper, we bring forth the words of the independent studies and experts in the hope that the public can better decide whom and what to believe.

Background

Although the State of Arizona generally prohibits transporting groundwater into an Active Management Area, there are a few exceptions, and Prescott was granted the right to import Big Chino groundwater. The issue in dispute is the effect withdrawals would have on the nearby upper Verde River. Although Prescott and Prescott Valley officials want to import that groundwater, they have said they do not want to affect the river. Not surprisingly, their claim has been that they can withdraw groundwater from the Big Chino Valley without affecting the river.

In the early 2000s, then Prescott mayor Sam Steiger was quoted as saying that the only way we would know if pumping would affect the Verde River is by actually pumping, and he proposed test pumping from the city-owned Dugan Well. That experiment did not occur, likely because staff or consultants informed him that the proximity of the Dugan Well to the headwaters of the river would quickly demonstrate reduced flow in the river.

Prescott officials thus decided that it would be in their interest to withdraw groundwater farther up the Big Chino Valley, and they purchased property to do so. The up-valley location has two effects. The much greater distance from the Verde River means that the effect of pumping may not be seen in the river for several decades, and the pumping would be behind a formation of fine- grained sediments, which they infamously call the "clay plug."

The Clay Plug Myth

The idea behind the clay plug is that the section of fine-grained sedimentary deposits within the Big Chino Valley serves to completely isolate the upper section from the lower section of the valley and thus from the Verde River itself. The imaginative idea is that one can withdraw groundwater from the upper valley and not affect the river. Water table elevations (well data), however, show that groundwater flows through, around and under the fine-grained materials.

Furthermore, if the flow of groundwater in the upper part of the valley were blocked by a "clay plug," it would have to discharge to the surface up-valley from the "plug," forming an obvious wetland, pond, or spring-fed stream. No such discharge exists. Although there are fine-grained deposits, they do not form a plug!

Independent Studies and Experts

Lay people recognize that the most trusted opinions come from experts practicing and publishing in the field with no financial or political stake in the issue, in contrast to entities that have a stake or little or no expertise.

The Citizens Water Advocacy Group (CWAG) has heard and gathered opinions of independent experts and one City-hired stakeholder expert, all of whom have concluded that pumping and transporting groundwater from the Big Chino Valley will reduce Verde River flow. The only contrary opinions have come from non-expert public officials and staff with a financial or political stake.

Government Studies

Three major independent government studies have determined that the Verde River is the only outlet for groundwater flow from the Big Chino Valley with the obvious conclusion that if you withdraw groundwater, you are taking water that would have gone to the river. Thus, all agree that withdrawals will reduce flow to the river. The three studies are listed as follows:

1. Big Chino Groundwater Study Technical Report: Darrell B. Ewing, John C. Osterberg, W. Robert Talbot: Bureau of Reclamation, Denver, Colorado; February 1994

2. Arizona Department of Water Resources (ADWR) Study of Verde River Watershed, 2000

3. Hydrogeology of the Upper and Middle Verde River Watersheds, Central Arizona; USGS Scientific Investigations Report 2005-5198 (aka Blasch Report)

1. **US Bureau of Reclamation Study, 1994**

Below is a quote from the Findings and Conclusions, Section 1, page 7.

> "The results of this investigation suggest that groundwater pumping in the upper Big Chino Valley would have an adverse effect on the flow and perhaps the biota of the Verde River."

2. **ADWR Verde River Watershed Study, 2000**

The report section, Groundwater Flow Patterns (page 4-10), explains that groundwater from the northern portion of the Big Chino Valley flows toward the southeast where it converges with groundwater coming from the Williamson Valley portion of the Big Chino Valley. The groundwater continues eastward toward Paulden and exits to the Verde River. The report on page 4-4 mentions a thick unit of clay estimated to be 700 feet thick, but recognizes no impediment to down-valley groundwater movement. Thus, there is a clay deposit, but it is not a plug.

The water budget developed in the report (pages, 5-3, 5-7, 5-8) shows the river as the only natural discharge from the Big Chino sub-basin system. As such, an increase in pumping will be counterbalanced by a reduction in river flow.

3. **USGS 2005 (**Blasch Report)

Below is a quote from the US Geological Survey report, Abstract, page 1.

> "Ground-water outflow from the Big Chino Valley occurs only as base flow in the Verde river."

Experts and Important Entities (chronologically)

1. **John Hoffman, USGS**

John Hoffman, Director of the US Geological Survey, Arizona Water Science Center and an author of the aforementioned report, asked and answered his own question as follows:

> "Will groundwater pumpage from the Big Chino sub-basin reduce groundwater outflow from the Big Chino sub-basin to the Verde River? "And the answer of course is 'Yes.' It is not a matter of if. It is just a matter of when."
>
> Verde Watershed Association Presentation, June 21, 2007

2. **Herb Guenther, ADWR**

Herb Guenther, as Director of the Arizona Department of Water Resources, spoke for the State.

> "If we significantly exceed natural and artificial recharge, the probability is ... we eventually impact the base flow of the Verde River."
>
> Daily Courier, November 10, 2007

3. **Arizona Department of Game and Fish**

The AZ Department of Game and Fish has an obvious interest in seeing that the baseflow of the Verde River is maintained.

> "The Department believes the action outlined in the ADWR notice to transfer groundwater to Prescott will substantially reduce baseflow in the upper Verde River, resulting in significant impacts to wildlife habitat, as well as direct impacts to the Department's Upper Verde Wildlife Area."
>
> Letter to ADWR, September 12, 2008, concerning Prescott's Assured Water Supply application to import groundwater from the Big Chino valley

4. **Senator John McCain**

As Arizona's US senator, McCain has an interest in understanding the issue.

> "We all know the Verde River is threatened, OK?" McCain told The Daily Courier before Tuesday's private meeting. "And all of us are committed to see that not happen. So we all have a common goal here."
> "Herb (ADWR Director Guenther) says the Verde River will go dry," McCain related. "Now, as to the argument as to when, Herb's not that specific."
>
> Daily Courier, December 30, 2008

5. **Frank Corkhill**

The State's Department of Water Resources' Chief Hydrologist testified under oath:

> Attorney Question:
> "…that water taken out of Big Chino would have to result in a reduction in flows to the headwaters of the Verde River?"
>
> Corkhill Answer:

"My opinion, that would happen."

Hearing for Assured Water Supply Application for importation of Groundwater from the Big Chino Valley, April 15, 2009

6. **William Greenslade**

The City of Prescott hired William Greenslade, hydrogeologist with Southwest Groundwater Consultants, to testify for the City. He was asked on cross examination if he agreed with Corkhill (ADWR) that the Prescott pumping would impact the Verde Springs and headwaters:

Attorney:
"But you agree it will have an effect?"

Greenslade:
"I agree it will have an effect."

Hearing for Assured Water Supply Application for importation of groundwater from the Big Chino Valley, April 15, 2009

Conclusion of the Pre-2011 Studies

The preceding studies and experts clearly concluded that withdrawing water from the Big Chino Valley as proposed by Prescott and Prescott Valley would reduce flow in the Verde River, based largely on the well data and geology. These studies clearly show that mitigation measures would be needed to offset loss of streamflow if withdrawals were to proceed.

USGS Groundwater Model, 2011

Although the well data and the geology can tell us that withdrawals will affect the Verde River, information about the ability of the basin's aquifer system (basin-fill deposits and underlying bedrock) to transmit groundwater is used to estimate how long it will take for the effect to appear in the river. This information usually is presented in the form of a computerized numerical groundwater model.

After years of study and expense, in 2011 the USGS published a groundwater model of Northern Arizona including the Big Chino Valley," Regional Groundwater-Flow Model of the Redwall-Muav, Coconino, and Alluvial Basin Aquifer Systems of Northern and Central Arizona Scientific Investigations Report 2010-5180." Although previously we had sufficient information to know that groundwater withdrawals would reduce flow in the Verde River, we now can estimate the time it would take for such effects to be observed in the river. A number of withdrawal scenarios have been evaluated for interested parties.

Current Modeling Work

As with the earlier studies by independent government agencies, the USGS model outputs were not accepted, and were even derided in some cases, by the parties interested in withdrawing groundwater from the Big Chino Valley. Prescott and Prescott Valley currently are collecting data they believe will improve or correct the USGS model to somehow show that withdrawing groundwater from the Big Chino Valley would not affect the Verde River. Success is more than doubtful.

CWAG Experts

CWAG experts were not included in the sections above to let the reader draw his or her conclusion with minimal perceived organizational prejudice. However, it is beneficial for the readers to understand that current or former CWAG members with considerable expertise have thoroughly reviewed the studies and agree with the experts cited above that withdrawing groundwater from the Big Chino Valley will reduce flow in the Verde River.

- Edward Wolfe, PhD, retired USGS geologist, applies his experience in northern Arizona geology in providing and explaining the geologic context for the occurrence and behavior of groundwater in the Verde River watershed.

- Peter Kroopnick, PhD, retired hydrogeologist and former adjunct professor of hydrogeology at Arizona State University, has been running the USGS numerical groundwater flow model on his computer since it was published in 2011.

- William Meyer, retired USGS hydrologist, has extensively reviewed the hydrology and modeling studies of the government agencies of the Big Chino Valley.

Conclusion and Observation

A broad spectrum of experts agrees that withdrawing and transferring groundwater from the Big Chino Valley to the Prescott region will reduce flow in the Verde River. Community officials in the Prescott region need to heed the determinations of the independent experts cited.

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