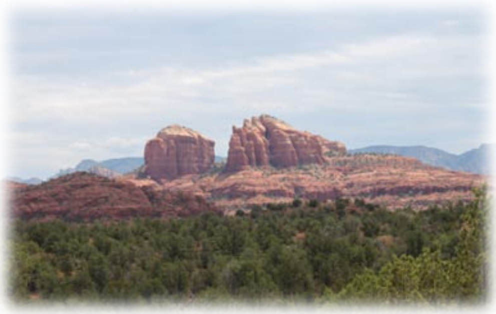
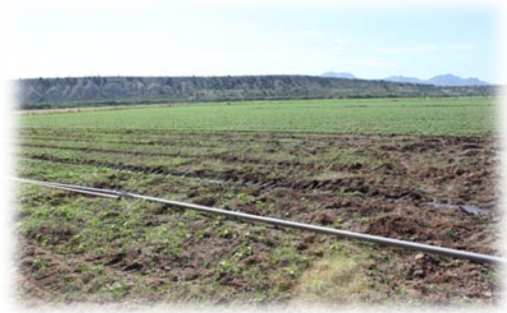
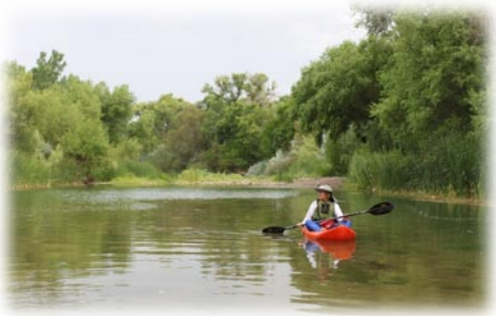
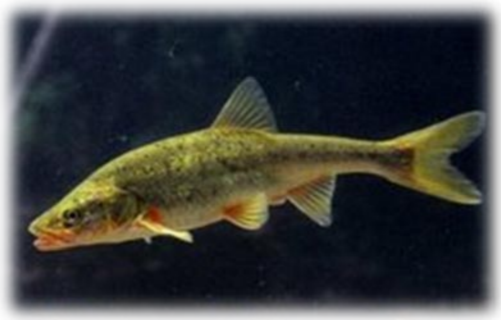
Policy Options for Water Management in the Verde Valley, Arizona

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Protecting nature. Preserving life.™

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Cover photos: Roundtail chub, locally known as the Verde trout (courtesy of Arizona Fish and Game Department); other photos by James Limbrunner.

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Executive Summary

A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it.

Justice Oliver Wendell Holmes, opinion in the 1931 case of *New Jersey v. New York*

The water of the Verde Valley, both in the ground and flowing at the surface, is a natural resource that is critical to the regional economy, environmental sustainability, and quality of life—but the Verde River faces unprecedented threats from over-allocation, development, and lack of cohesive water management. This report presents the results of three related initiatives designed to examine possible futures for the Verde and provides information for stakeholders and decision makers regarding the Verde Valley's water resources, its economic value, and possible tools for sustainable water management.

Our analysis included modeling the effects of growth on river flows and on the regional economy. Population growth and development in the basin, if not mitigated, are likely to cause further decrease in the summer base flow in the Verde River. Decreases in the Verde River's flow have already been observed, and further reductions could have harmful side effects on the region's economy and could lead to federal intervention in local water management to maintain habitat for endangered species.

Planning-Level Water Management Model

A planning-level water management model was developed for the Verde Valley to quantify the potential effects of two groundwater withdrawal scenarios on river flow and to study possible management alternatives.

Under a mid-range growth scenario, increases in groundwater withdrawal are projected to cause annual flow volume in the Verde River to decrease by about 3,000 acre-feet by 2050, equivalent to a flow-rate reduction of about 4 cubic feet per second. This scenario projects median summer monthly flow near Camp Verde to decrease by about 6 percent by 2050. Under a high-growth scenario, increases in groundwater withdrawal are projected to decrease annual flow volume in the Verde River by almost 8,000 acre-feet (or 11 cfs) by 2050. This high-growth scenario projects median summer monthly flow near Camp Verde to decrease by 15 percent by 2050.

Larger decreases in streamflow are likely in the future, with potential reduced inflow to the Verde Valley due to groundwater extraction in the Big Chino and Little Chino basins, climate change, and the arrival of effects caused by pumping in the Verde Valley prior the beginning of the study period. Without reduction of groundwater pumping, additional streamflow depletion in the years following 2050 is likely.

We considered four different water management alternatives for how they might affect streamflow and aquifer levels in the Verde Valley and the regional economy. The alternatives are generally analogous to management approaches implemented by states considered in the case studies:

A0 No change in current management approach (base case)
A1 State-level regulation

A2 Regulation with market-based trading
A3 Regional water management institution

Management alternatives that cap groundwater extraction can reduce projected streamflow depletion in the Verde River.

Economic Analysis

Total economic activity in the Verde Valley amounts to approximately $1 billion to $1.5 billion per year. We examine how changes in water resources may impact economic values for the community that are closely related to use of the Verde River and related groundwater system, concentrating on economic values that: 1) are the largest water-related values; 2) have the greatest sensitivity to changes in flow or changes in groundwater levels; and 3) for which some form of quantitative valuation is feasible given available methods.

Among these economic values are $87.5 million per year for tourism activities closely related to water use on the Verde River—and the indirect economic boost when residents with incomes increased by tourism spend their earnings locally. A regional economic model (IMPLAN) generates an estimate of $16 million in multiplier effects from the $87.5 million, and creation of 737 jobs from tourism and recreation expenditures related to river use for which we had data.

ES Table 1 Summary of Economic Values from the Middle Verde River (annual values, millions of 2010 dollars)

Sector	Current Annual Value, $Million
Recreation and Tourism	87.5 *
Production Agriculture	29
Wine Industry	5.5 *
Municipal/Residential	13–17.5
Commercial/Industrial	**
Ecological	15–22
Total	150–161.5 +

* In addition to direct values, there are multiplier effects for these sectors.
** Commercial/industrial values are generally believed to be large but cannot be estimated given the difficulty in locating information.

Loss of flows in the Verde River and a lowering of the water table can adversely affect these economic values. The economic analysis presented here estimates the value of those water uses and the sensitivity of those values to changes in water availability. Streamflow changes estimated in this study were used to assess the potential loss of annual value derived from the Middle Verde River. The table below summarizes the results.

ES Table 2: Summary of Economic Values from the Middle Verde River and Potential Loss of Annual Value (annual values, millions of 2010 dollars)

Sector	Sensitivity to Streamflow Change	Potential Loss of Annual Value, $Million
Recreation and Tourism	varies	1.9–4.7
Production Agriculture	medium	2.5
Wine Industry	**	0.3
Municipal/Residential	**	1.8–5.3
Commercial/Industrial	**	0–0.2
Ecological	high	0.9–3.3
Total		7.4–16.3

** Groundwater dependent.

Several water management options for the Middle Verde River were shown to provide crucial methods for stopping streamflow depletion and groundwater level declines:

Regulatory option: protects existing uses by placing a cap on overall groundwater use in the Verde Valley. Regulations can impose costs on residential and commercial/industrial sectors if growth is restricted due to the groundwater use cap.

Water marketing option: allows transfers of groundwater and surface water rights that can mitigate losses. This scenario provides greater net benefit compared to the regulatory option because losses to residential and commercial/industrial sectors are avoided.

Regional water management option: builds on the water marketing option with better coordination of local water management and potentially provides money through collected fees or water rights sales that can be used to promote projects that increase available supplies or reduce water demand, such as water conservation, increased water recycling, or stormwater capture.

Case Studies

We present three case studies of water management in Western states, examining how different regions have approached the question and addressed the complex decisions involved in sustainable groundwater management to maintain instream flows.

The **Middle Rio Grande Basin in New Mexico** suffers from groundwater overdraft and faces the challenge of growing water demands, primarily driven by rapid population growth. Unlike in Arizona, New Mexico has engaged in conjunctive management for decades, with the state requiring the acquisition of water rights for most new groundwater uses.

Despite the imposition of a cap on groundwater withdrawals by the state, program rules allow new water uses as long as the user promises to offset these in the future. Proponents praise this incremental approach, which has allowed continued development. Critics call it a giant loophole that allows environmental degradation to continue or even worsen, while putting off the difficult decisions about land fallowing or the expense of securing alternative water supplies.

Recent water policy developments have been motivated by the need to protect the endangered silvery minnow; a regional coalition created to comply with the Endangered Species Act has attracted substantial federal funding, with Congressional authorizations of $116 million since 2003. The city of Albuquerque has also made tremendous strides in reducing per capita water use, although population growth continues to be a major driver behind water use and declining aquifer levels in the basin.

In the **Deschutes River Basin in Oregon**, water managers and policymakers have recognized the importance of dealing with groundwater to protect surface water flows. Market-based strategies provide for continued growth and maintain a healthy river. Oregon has the most comprehensive and straightforward laws to protect instream flow, which has served as a model to other states as they seek to preserve river flows for recreation and habitat.

In 2005, Oregon launched the Groundwater Mitigation Program, stipulating that new groundwater permits could not be issued in the Deschutes unless the applicant could mitigate the impact of the withdrawal on streamflow with a similar amount of water put instream. Groundwater pumpers can purchase “mitigation credits,” and the state created “mitigation banks” to facilitate transactions among willing buyers and sellers and to avoid profiteering.

Oregon’s Conserved Water Program creates an incentive for irrigators to participate in water conservation programs that benefit wildlife. A portion of the water saved through water efficiency upgrades is dedicated to instream flow, while irrigators retain the remainder of the savings which can be applied to additional land, sold, leased, or donated for instream use.

The **Edwards Aquifer in south central Texas** is an important groundwater resource, supporting thousands of acres of irrigated agriculture and supplying water to San Antonio, the country’s seventh-largest city. Texas created the Edwards Aquifer Authority (EAA) in 1993 for the express purpose of preserving spring flows and maintaining endangered species habitat, and gave it the power to regulate water users. The EAA was tasked with capping pumping at specific levels and buying down existing water rights by 2008, at a potential cost of hundreds of millions of dollars. Today, all wells producing more than 17 gallons per minute from the Edwards Aquifer must be permitted. Pumpers must hold rights and must pay fees for their water use. The EAA is now self-sustaining, with the majority of its revenues coming from permit fees.

In addition, the city of San Antonio has taken strong steps to protect the aquifer and its water supplies. Since voters approved a 1/8-cent sales tax, the city has spent more than $135 million to protect natural lands within the aquifer’s recharge zone. Recently, the city has focused on purchasing *easements* rather than buying land outright. This program has allowed land to stay in the hands of private owners and preserves traditional land uses like ranching, hunting, or fishing while maintaining aquifer recharge and protecting water quality.

Water Management and Policy Options

In Arizona, 35% of natural perennial-flowing rivers have been altered or lost as a result of dams, diversions, and groundwater pumping. There are a number of aspects of a healthy river. In this report, we have focused on maintaining instream flows, and specifically on how excessive groundwater withdrawals can reduce flows, causing harm to the river, wildlife, and the communities around it.

Any pumping in an aquifer that is geologically connected to a river will affect flows in the river. It is more difficult to measure the extent and movement of groundwater than surface waters, making it more challenging to regulate and manage. In Southwestern rivers like the Verde, the effects of pumping may not be seen for decades. This long time lag prevents the public from seeing and understanding groundwater-surface water connections, creating an additional barrier to crafting meaningful policies to protect rivers from over-pumping.

Arizona reformed the way groundwater is managed in the state with the passage of the Groundwater Management Act in 1980. As a result, the use of groundwater in Arizona is highly regulated within Active Management Areas (AMAs), of which there are currently five. The five AMAs cover 80% of the population, but only 13% of the land, leaving rural areas of Arizona with few options for controlling overexploitation of groundwater. Declaring a Verde AMA will not be sufficient to protect the river from groundwater overdraft, as the law provides few means to protect rivers.

To better manage groundwater and protect instream flows in the Verde River Basin, several elements are needed.

In this report, we present over a dozen policy and management alternatives. Reforming water management is almost never fast or easy, but all of the options presented are drawn entirely from experiences that have worked in other Western states. Successful approaches must however be adapted to fit the unique legal, cultural, and hydrologic setting in Arizona and the Verde Valley. The options can be broken down roughly into four categories:

Water management
–Enhance water conservation and efficiency
–Increase the use of recycled water
–Modernize irrigation infrastructure
–Enhance aquifer recharge

Legal reforms
–Advocate for legal protection of instream flows
–Require reporting of water use
–Regulate groundwater pumping to sustainable levels
–Mitigate new water uses
–Deal with exempt wells
–Press for adjudication of water rights
–Pursue endangered species act protections for the Verde's aquatic species

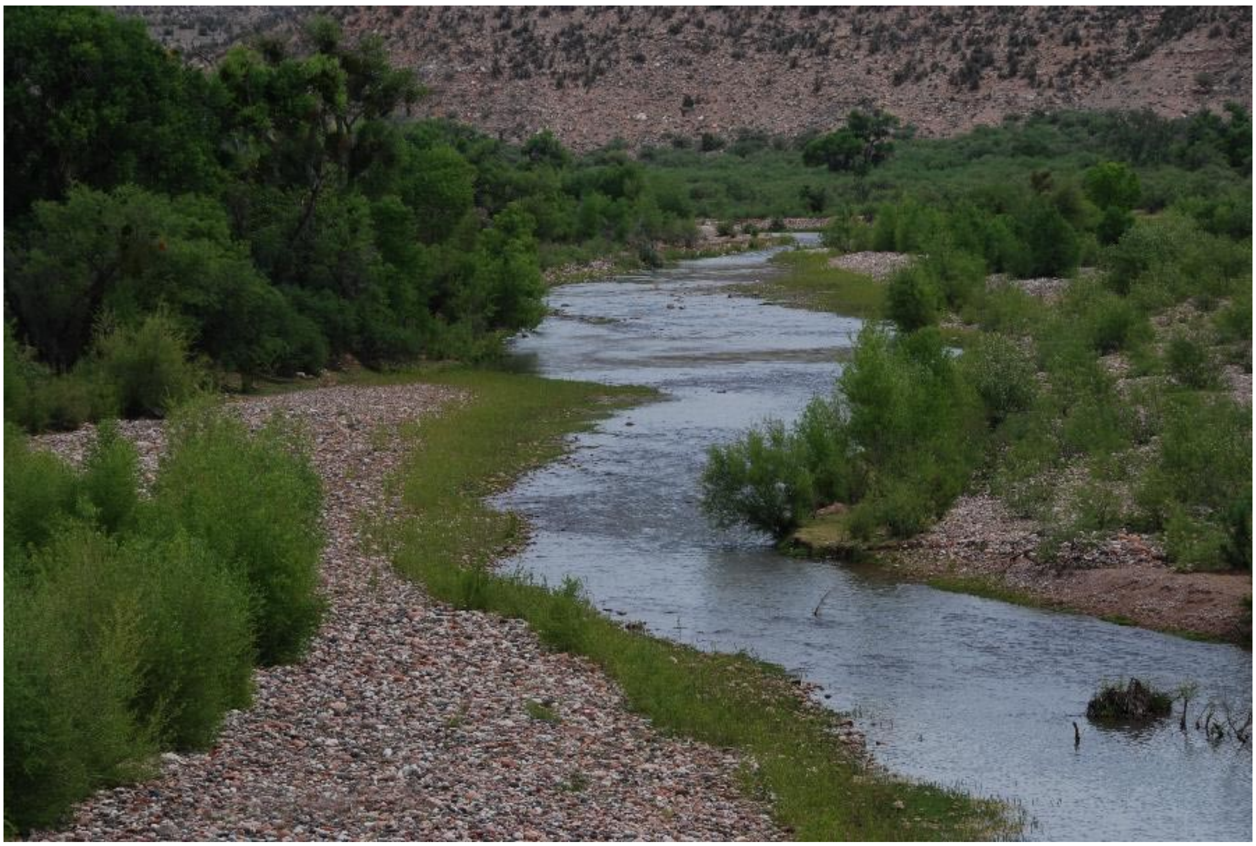
Economic and market-based measures
–Charge groundwater extraction fees
–Allow interested parties to purchase or donate water for instream flow
–Create water banking

Administrative or institutional actions

–Create the Verde River Active Management Area

–Create a Verde River Conservation District

Our analysis demonstrates that the water resources of the Verde River basin, if managed wisely, can meet the needs of cities, farms, and nature, as well as provide for future growth. Cooperation, smart economics and planning, and efficient use can lead to a continued high standard of living for residents, robust economic activity, and maintenance of the magnificent ecological setting that attracts visitors from around the world.



Verde River near Clarkdale, Arizona. Photo courtesy of Walt Anderson.