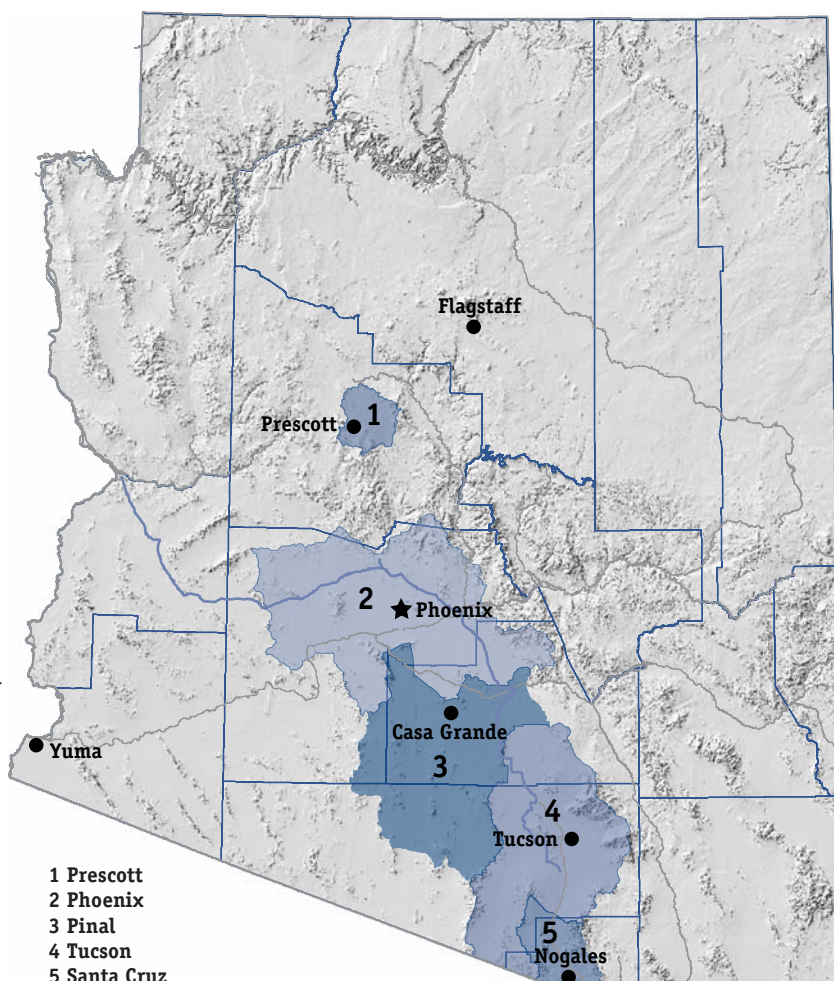


Water is a scarce commodity in Arizona. While market forces tend to determine the allocation of most goods and services, a complicated system of law and institutions superimposed on varying land and water forms and patterns of development makes the allocation of water resources extraordinarily complex. Add to that Arizona's rapid population growth rates, the potential for conflict over water resources is great.

The quote attributed to Mark Twain, "Whiskey's for drinking, water's for fighting about," points to a long history of water resource conflicts. No stranger to water conflicts, Arizona has a good record of resolving them. The 1980 Groundwater Management Act is hailed as an innovative, successful framework for managing groundwater in parts of Arizona designated Active Management Areas. Figure 1 shows the location of the five AMAs. Enactment of rules governing new municipal uses of groundwater and increasingly stringent water management plans have assisted the AMAs in moving toward their state-mandated groundwater management goals. Since the passage of the Act, the Central Arizona Project has been completed. Its delivery and storage capabilities have provided dry and thirsty Central Arizona communities with surface water needed to sustain and grow their economies.

Despite our great strides, the recently released United States Department of Interior report, *Water 2025: Preventing Crises and Conflict in the West*, confirms what we already knew here in Arizona: "...explosive population growth..., the emerging need for water for environmental and recreational uses, and the national importance of the domestic production of food and fiber from western farms and ranches is driving major conflicts between these competing uses of water." Figure 2 shows varying levels of future water supply crises in the West. Arizona has more than its share of shaded area, including sizable areas outside AMA boundaries.

Arizona is not waiting for conflict to become crisis. The Groundwater Management Act continues to provide the framework for managing water resources in the AMAs. But what about other areas of the state? Recognizing the need for rural areas of the state to develop and implement long-term water plans, the legislature authorized the Arizona Rural Watershed Initiative. Funded for the first time in state fiscal year 2000, its purpose is to provide planning and other technical assistance to rural areas with expanding populations and limited groundwater resources. Watershed groups are actively involved in gathering information and considering their water management options. The remainder of this article provides an overview of the



Source: Arizona Department of Water Resources

Fig. 1 Active Management Areas

Managing to Avoid Crisis

A Look at Water Management Efforts in Rural Arizona

Sharon B. Megdal

smegdal@ag.arizona.edu

Associate Director, Water Resources Research Center
Professor and Specialist, Agricultural and Resource Economics
University of Arizona

Jacqueline Moxley

jmoxy@ag.arizona.edu

Research Specialist
Water Resources Research Center
University of Arizona

process and progress of these watershed efforts. Much of the information was gleaned from an annual Arizona Water Resources Research Center conference ("Local Approaches to Resolving Water Resource Issues") held in Prescott, Arizona in May of 2003.

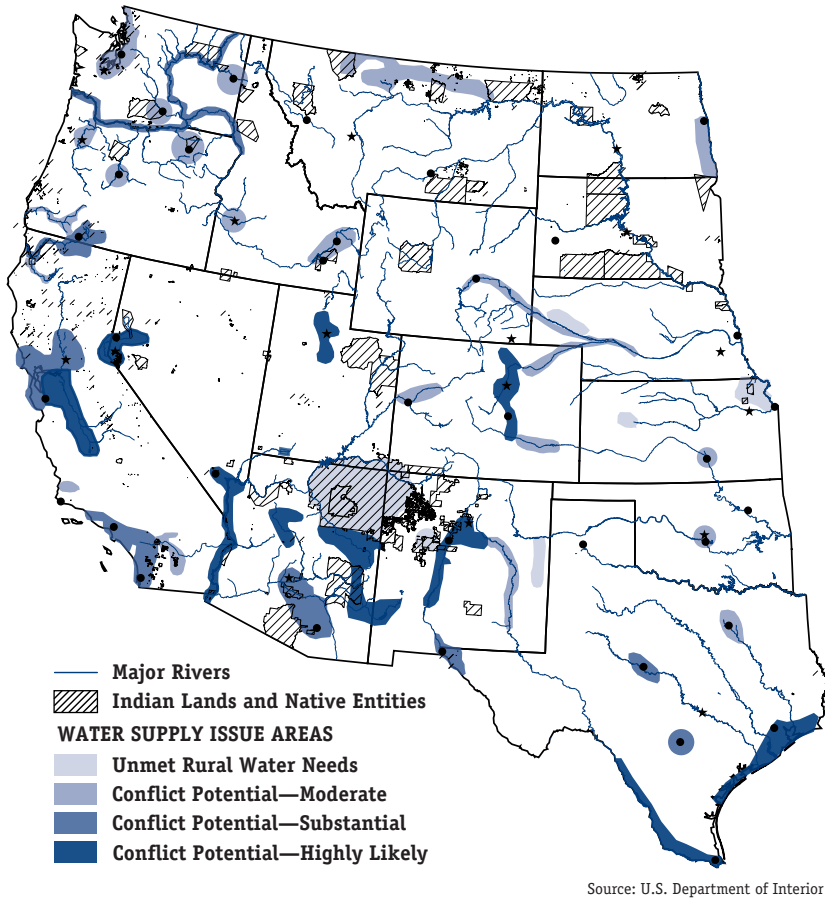


Fig. 2 Future Water Supply Crises in the West

Process Is Important

Resolving water management issues is a long and costly process. A large number of persons, groups, government agencies, and other entities concerned with water are typically involved. It is important to bring all stakeholders to the table, even those who may be disagreeable. Failure to be inclusive exposes the process to the risk that an overlooked or omitted party could in the end interfere with carrying out the agreed-upon plan. People need to listen to each other. Spending time and money to educate individuals from the beginning of the process is worthwhile, so that everyone has the same base information for informed dialogue.

The parties must develop a good working relationship if agreement to implement a plan is to be achieved. Everyone must know and understand the viewpoints of the participants. An independent mediator who facilitates negotiations, someone to listen and direct constructive discussion, can be helpful. While it is important that good, objective technical assistance be provided, the mediator may play the most critical role in arriving at a solution that the parties can agree to follow.

It is important to identify common goals and formulate the appropriate research questions to be

investigated. Collaborative regional efforts commonly lack funds for research necessary to fill information gaps. When seeking outside funding for research needs, success is more likely if the region speaks with a single voice rather than with competing ones. Federal agencies encourage and respond to locally developed approaches to investigating water issues. By providing funds and technical assistance, federal or state agencies can become key facilitators. The local or regional water groups, however, are the ultimate implementers.

Research takes time; data collection and development of groundwater models may take several years. However, “paralysis of analysis” is a risk. While it is usually desirable to base actions on more information rather than less, groups sometimes cannot wait for all the information before moving ahead, at least on some programs. It is possible to consider a variety of alternative strategies, some shorter term and some longer term. For example, some low-risk projects can be implemented while awaiting study results. Solving water issues is truly work in progress and requires creativity. There is no silver bullet or one-size-fits-all solution.

Throughout the process, water managers and others should work to keep the public and decision makers well informed. The process must be open, and any interaction with the public has to be meaningful and inclusive for solutions to be acceptable.

Once solutions are found, and an approach is negotiated, assurances for all parties have to be made and have to be enforceable for implementation to be successful. The work of the group is not over at that point; the commitment to the program or plan can extend far into the future.

A Selective Look at the Watershed Efforts

Watershed groups throughout the state, as shown in Figure 3, are actively involved in gathering information and considering their water management options. A look at the activities of some groups provides a glimpse of the variety and complexity of regional water challenges.

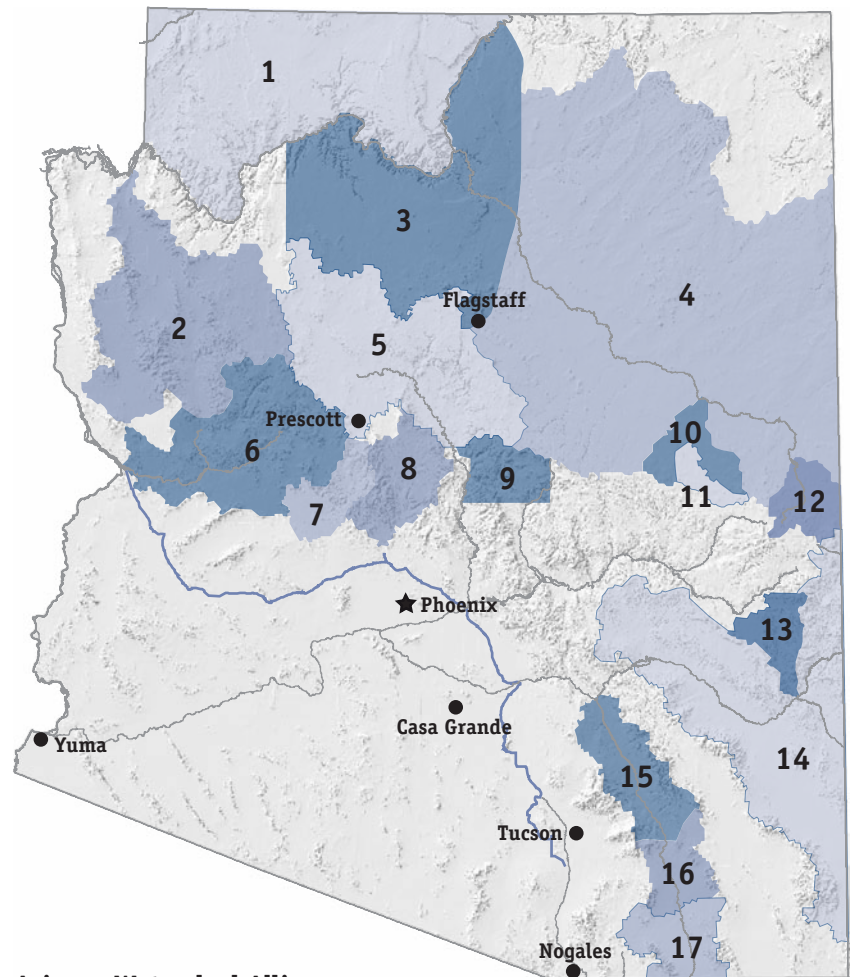
The Verde watershed, which includes rapidly growing parts of Yavapai County, is a hotbed of activity. The beauty of the region coupled with rapid growth rightly has people concerned about balancing the needs of nature with the needs of people. There is active participation of many diverse interests, and progress is being made in acquiring and disseminating information. The recently formed North Central Regional Watershed Consortium, in an effort to coordinate the many Verde watershed citizens groups, will share information and provide a stronger voice to further common goals.

Concern is significant about the activity of new and existing exempt wells in the Prescott AMA portion of the watershed and the unregulated drilling in the non-AMA portions of it. The situation is complicated because of the importance of surface water and the rights to that surface water. Prescott Valley, for example, which is located in the AMA, has faced incredible pressure due to the rapid growth rate and shortage of water supplies. In the last ten years residents have moved from septic systems to a water treatment facility and from private ownership of their water supply to municipal ownership. They have introduced conservation measures to reduce water use. Increases in impact fees, charges for water hookups for new single family homes, and water rates and wastewater reuse have helped to mitigate some of the water demand pressures, but Prescott Valley, as well as others in the region, recognizes the need to identify additional water sources.

The Gila River watershed, which includes the Safford area, supports cattle ranching, agricultural production, and mining. The watershed group is working to resolve pressing issues of water quality such as salinity, turbidity, non-point source pollution, and flood mitigation. There are concerns not only for endangered species, but reintroduced species and invasive plant species, and the associated costs of dealing with those concerns. Progress has been made to smooth old conflicts between agricultural and environmental groups, but lack of technical information and the funds needed to do the research are restricting the ability to resolve issues.

Flagstaff, part of the Coconino Plateau region, has successfully used a variety of conservation measures such that per capita water use has decreased one percent per year since 1990. Changes to the water rate structure have encouraged reductions in water use. A water conservation ordinance, effective May 15, 2003, for the first time imposes conservation requirements 365 days of the year. It is enforced by bike patrol and has penalties. The ordinance has been well supported by the public. Rebates and incentives for low flow toilets, conversions to gray water, turf reduction, and rain barrels have also been well received. A dual distribution system, online since 1992 and funded through a bond program, has enabled delivery of reclaimed water for outdoor irrigation. This resource is thought to be one of the most significant groundwater conservation tools the city has. Although Flagstaff has made strides in reducing groundwater use, the city and others in the region have yet to agree upon plans for augmenting water supplies.

The activities of Fort Huachuca and concerns about San Pedro River flows have been central to the endeavors of the Upper San Pedro Partnership. Formed in 1998, the partnership has brought twenty government



Arizona Watershed Alliance

- | | |
|--|--|
| 1 Arizona Strip | 10 Silver Creek |
| 2 Northwest Arizona Watershed Council | 11 Show Low Creek |
| 3 Coconino Plateau Regional Water Study | 12 Upper Little Colorado River Partnership |
| 4 Little Colorado Multi-Objective Management | 13 Eagle Creek |
| 5 Upper Verde and Middle Verde Studies | 14 Upper Gila |
| 6 Upper Bill Williams | 15 Lower San Pedro |
| 7 Upper Hassayampa | 16 Middle San Pedro |
| 8 Upper Agua Fria | 17 Upper San Pedro Partnership |
| 9 Northern Gila County Water Plan Alliance | |

Source: Arizona Department of Water Resources

Fig. 3 Rural Watershed Groups

agencies and private organizations together to develop a working water conservation plan for the Sierra Vista sub-watershed and the San Pedro River. This area is not in an AMA and there is no particular desire for that designation to occur. Reducing consumption, reclaiming and reusing water, and augmenting existing water resources are the three distinct water management strategies for this group. Watershed improvement projects to improve and restore grasslands and riparian areas and partnership-sponsored studies to provide research are also part of the mix. These measures are reviewed on an annual basis to assess the benefit to water resources management. Strong federal interest has assisted this group in investigating and pursuing this vast array of alternative solutions.

Common to these and other regional efforts is a desire for solutions to be developed at the local and regional level, rather than at a centralized (state) level. Nevertheless, there is a role for state and/or federal legislation, particularly when it comes to resolving Indian water claims and developing workable financing mechanisms. Funding the identified and agreed-upon projects is clearly a challenge for most regions of the state.

Concluding Remarks

In Arizona, water managers are faced with the difficult task of balancing limited water supplies with

the competing demands of population growth, economic development, and environmental needs. There may be complex layers of regulation, and financial resources are limited. Multi-dimensional solutions are required.

Watershed groups and those working collaboratively in other parts of the state are making progress in identifying and implementing solutions to their water problems. Their efforts to resolve water conflicts *before* they reach crisis stage deserve the involvement and support of all concerned about sustaining Arizona's economy and quality of life. **AR**

Acknowledgment. The authors thank Peter Wierenga for helpful comments.

Sharon B. Megdal's work focuses on Arizona water resources policy and management. Active areas of research include the role of the private sector in water delivery and long term water storage, regional approaches to water management, and how the desert's landscape has been affected by water management. She writes a public policy column for the Arizona Water Resource, the bi-monthly WRRC newsletter, and regularly makes presentations on water matters to diverse audiences.

Jacqueline Moxley is both a researcher and program coordinator at the WRRC. Research and analysis of data related to water issues in the state is the focus of her efforts. Current areas of interest include the role of the private sector in water delivery, effluent reuse, and home water treatment.

Dust Mitigation Via Reduced Tillage

The Economic Dimension

Airborne dust can aggravate cardio-pulmonary conditions leading to illness, higher medical expenses, and an increased number of sick leave days. The population in the western region of the United States is more prone to dust events due to climatic and physical environment: low rainfall, drought, high wind velocity, fine soils, and sparse vegetation. Dust storms have occurred naturally in desert areas for millennia. In recent decades, human activity has compounded the natural dust problem with agricultural production practices, an increase in construction activity on the urban periphery, and the ever-closer proximity of agricultural production to urban areas.

A federal-state partnership implements the Clean Air Act for improving national air quality. The Environmental Protection Agency (EPA) is responsible for developing national ambient air quality standards (NAAQS) and the Clean Air Act regulatory guidelines that the states use

to develop state implementation plans (SIPs). A SIP is a package of strategies and control measures to prevent air quality deterioration or reduce criteria pollutants (i.e., particulate matter, carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, and lead) that exceed NAAQS. State environmental agencies are the implementation leaders of the Clean Air Act because air quality problems are unique to each area of the country.

Wind blown dust is the primary component of one type of particulate matter, PM-10, consisting of "coarse" particulates 10 micrometers in diameter—10,000 could fit in the period at the end of this sentence. The EPA is responsible for establishing the primary (protecting public health) and secondary (protecting the environment and public welfare) standard for each NAAQS. For PM-10, the primary standard consists of an annual standard (50 micrograms per cubic meter [$\mu\text{g}/\text{m}^3$]) and a 24-hour standard (150 $\mu\text{g}/\text{m}^3$).

Ana Kennedy

aken02@hotmail.com
Graduate Student
Agricultural and Resource Economics
University of Arizona

Paul Wilson

pwilson@ag.arizona.edu
Professor
Agricultural and Resource Economics
University of Arizona