Gains from Trade: Arizona's Groundwater Savings Program*

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Arizona's Groundwater Savings Program (GSP) is a cornerstone of the state's overall Groundwater Storage and Recovery Program. Borne out of Arizona's efforts to use its Central Arizona Project (CAP) allocation fully, the GSP serves as a low-cost means of utilizing renewable, surface water supplies.

Early CAP Water Use: Not According to Plan

The CAP is a 336-mile canal that delivers about 1.5 million acre-feet of water annually from the Colorado River to Maricopa, Pima, and Pinal Counties in central Arizona. (An acre-foot of water, or 325,851 gallons, is the amount of water needed to cover an acre of land with one foot of water.) Built by the U.S. Bureau of Reclamation, the CAP lifts water from near sea level to about 2,800 feet at its highest point in Pima County. As part of the federal-state partnership to construct the CAP, the federal government required that Arizona regulate groundwater use and Arizona enacted the Groundwater Management Act of 1980 to control groundwater overdraft in central Arizona. The Act included designation of Active Management Areas (AMAs), where the Arizona Department of Water Resources would enforce groundwater management regulations. Today, the AMAs include five distinct hydrologic regions: Prescott, Phoenix, Pinal, Tucson, and Santa Cruz (Figure 1). The CAP services Maricopa, Pima and Pinal Counties.

While the federal government fronted the $4 billion cost of constructing the canal, Arizona was to repay a large portion of the cost over time. Arizona established the Central Arizona Water Conservation District (CAWCD) to oversee project operations and the repayment. An important clause in the repayment contract held that the state would pay 3.3% interest on the portion of the project delivering municipal and industrial water, while deliveries of agricultural water would be interest-free. So, it was in the state's financial interest to encourage agricultural use of CAP water.

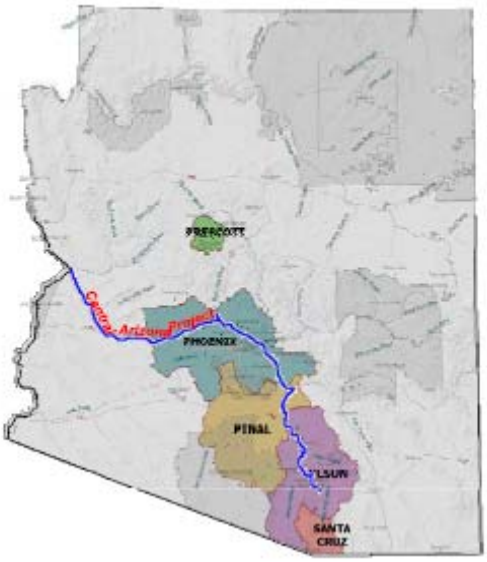

Figure 1. Arizona's Active Management Areas

The CAP was built to support urban growth in the long-term, but was conceived to sustain central Arizona's agriculture in the short- to medium-term. Prior to construction, many in the state expected that non-Indian agriculture would buy 60 to 80 percent of the CAP supply for the first decades of operation. As central Arizona urbanized and developed the infrastructure to accept CAP water for residential use, urban areas would exercise fully their subcontract rights for CAP water and non-Indian agriculture's use of CAP water would diminish.

But early agricultural demand for CAP water did not meet these expectations. Prior to the CAP's completion, economists indicated that irrigators that had lower-cost alternatives to CAP water would find CAP water uneconomical to use. These predictions turned out to be largely correct. Although many agricultural districts in Pinal and Maricopa Counties entered into contracts for CAP water; many agricultural landowners in the three-county CAP service area declined to purchase CAP water when it became available. Upon completion of the CAP canal, the cost of purchasing CAP water was too high relative to lower-cost, alternative supplies available to agricultural entities. These economic factors, combined with wet weather conditions, reduced deliveries of CAP water to non-Indian agriculture by 48 percent between 1989 and 1991.

Making CAP water affordable to agriculture

In response to this shortfall in agricultural demand for CAP water, and as part of a larger effort to increase utilization of CAP water, the CAWCD established an agricultural pool program that made CAP water available to irrigators at a reduced rate. This target-pricing program charged irrigators a rate below the actual cost of delivering CAP water. Agriculture's response was swift: CAP agricultural deliveries surged from less than 60,000 acre-feet in 1993 to more than 500,000 acre-feet in 1994. This arrangement reduced the interest payments to the federal government for the CAP's construction costs because greater agricultural deliveries reduced the average interest rate. (A later settlement between the federal government and the CAWCD fixed the repayment obligation such that it no longer depends on the proportion of CAP deliveries made to non-Indian agriculture.)

Underground Storage and Recovery Programs

In addition to the new system of target pricing, another creative means of encouraging CAP deliveries to agriculture developed in tandem with increasingly strict regulations on municipal use of groundwater. In 1995, the Arizona Department of Water Resources (ADWR) adopted the Assured & Adequate Water Supply Rules. The rules require that new development demonstrate the availability of a water supply to serve the water demand of the proposed subdivision for 100 years. In the centrally located AMAs, the rules also limit the amount of groundwater used to demonstrate an Assured Water Supply. In effect, the Assured Water Supply Rules require new development to rely largely on renewable water supplies (especially in the Phoenix and Tucson AMAs), and CAP water is the most readily available renewable water supply in the Phoenix, Pinal, and Tucson AMAs. Efforts to comply with the new rules quickly led to the expanded use of Arizona's existing Underground Storage, Savings and Replenishment Program, including the indirect use of CAP water through voluntary exchanges with agriculture. This arrangement, known as the Groundwater Savings Program (GSP), is prominent in Arizona's efforts to utilize its renewable water supplies.

The GSP is a partnership between cities looking to use their CAP allocations where direct delivery is too expensive, and irrigators looking for low-cost water supplies. It also is a mechanism used by cities and others to store water and accrue credits for future recovery. Sometimes called indirect recharge or

in-lieu recharge, the GSP allows storing entities to accrue groundwater storage credits when irrigators use surface water or effluent in place of groundwater. Since 1992, agricultural districts have partnered with entities such as municipalities, private water providers, CAWCD, and the Arizona Water Banking Authority (AWBA, the independent government authority authorized to store CAP water for times of drought). Through the GSP, these entities are able to provide CAP water to irrigators at a cheaper rate than what irrigators would pay directly, and by subsidizing the delivery of CAP water to the irrigator, they earn storage credits as compensation for the groundwater saved through the transaction. Since 1992, approximately 3.5 million acre feet of CAP water have been used instead of groundwater at groundwater savings facilities (GSFs) in the three central Arizona AMAs (Figure 2). The AWBA has also used groundwater savings facilities to store water in Arizona pursuant to an interstate water banking agreement with Nevada.

To participate as a GSF, an irrigator must first prove to ADWR that CAP water (or other surface water or effluent) will substitute gallon-for-gallon for the groundwater that the irrigator would have used. Having demonstrated its legal and physical ability to pump groundwater, the irrigator then receives a Groundwater Savings Facility Permit. For a water utility to participate as a storer, the utility must obtain a Water Storage Permit to store water at the GSF. If the water utility wishes to recover some of the water stored at a GSF after the end of the calendar year, it must obtain a long-term storage account with ADWR to be able to keep an account of the water stored at the GSF. For example, if 100 AF are stored at a GSF in August and are not recovered until the following January, then the stored water is added to the utility's long-term storage credit account. Because the water was not recovered within the same calendar year it was stored, the long-term storage credits available to the utility are 95% of the original volume stored, or 95 AF. The other five AF become a "cut to the aquifer" for aquifer replenishment.

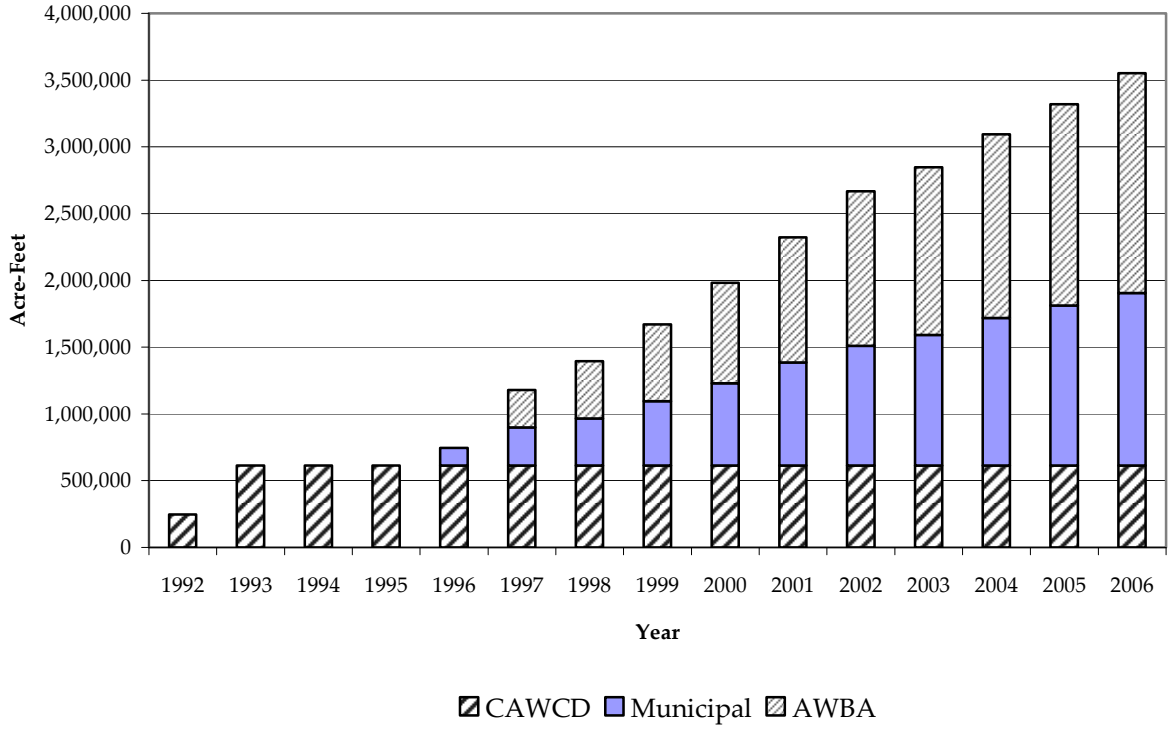

Figure 2. Cumulative Storage at Groundwater Savings Facilities through 2006 by Type of Storer

Some Concerns

Concerns about the Groundwater Storage Program have mainly centered on the perpetual groundwater use rights of agricultural water users in the Active Management Areas. Should affordable CAP water no longer be available, the agricultural entity has the right to return to groundwater use and benefit from the higher water levels resulting from not having pumped the groundwater while using CAP water. There are also questions about the water management implications of recovery outside the area of hydrologic impact, potentially resulting in recovery at significant distance from the storage. (This concern is not unique to the GSP.) The chart above shows that much of the GSP storage has been on behalf of CAWCD and the AWBA, with planned recovery occurring in the future and perhaps outside the area of hydrologic impact. Because entities have yet to develop recovery plans, the potential hydrologic disconnect between storage and recovery is a concern.

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Storage at GSFs has the advantage of lower costs. The storing entity usually pays only a portion of the CAP water costs, with the agricultural user picking up the rest. In most cases, there is no facility charge associated with storing groundwater at the site. This is in contrast to storage of CAP water at underground storage facilities (USFs), at which the storing entity pays the entire cost of the water to be stored in addition to a charge paid for use of the USF. Recovery considerations can be advantageous at GSFs as well.

The Arizona Department of Water Resources also regulates the recovery of stored water. Details of recovery regulations are beyond the scope of this paper. It is important to note, however, that for an agricultural district, a GSF's area of hydrologic impact is the entire district. For a large district like the Salt River Project, this means that recovery well permitting is relatively easy anywhere within its boundaries.

What is unarguable about the GSP is that this voluntary water exchange mechanism benefits the participating entities while furthering Arizona's water management objectives. The program enables municipal water providers to utilize CAP water indirectly and inexpensively to comply with regulatory requirements for use of renewable supplies. It is a relatively low-cost alternative for the AWBA. Irrigators benefit from water costs below what they otherwise would incur, courtesy of their groundwater savings partners. The popularity of the groundwater savings program is based on a simple economic principle. Voluntary transactions yield mutual gains.

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