Designing Water Conservation Policies That Match Sense With Cents: A Case Study Approach

Water Policy Working Paper #2005-005

Prepared by

Ronald G. Cummings and Douglas Wilson*

January 2005

* Georgia Water Planning and Policy Center, Andrew Young School of Policy Studies, Georgia State University, and the Albany Central Office, respectively. The authors gratefully acknowledge financial support for this research provided by the Georgia Soil and Water Conservation Commission and the U.S. Department of Agriculture. Research assistance provided by Ms. Deborah Arundale is also acknowledged as is an extraordinary editing of the paper by Ms. Kristen Rowles.

Designing Water Conservation Policies That Match Sense With Cents:
A Case Study Approach

Abstract

As Georgia increasingly faces the strains imposed by water scarcity, there is growing interest in water conservation programs as a means for dealing with the scarcity problem. There are many types of residential water use conservation programs found in communities across the United States. An important question then becomes: is there one, or possible one set, of conservation policies that apply to all conditions of water scarcity faced by communities with water scarcity problems — i.e., does a "one size fits all" approach to the design of conservation programs make good sense?

In an effort to address this question, we conduct case studies of two cities that face very different water scarcity conditions: Albuquerque, New Mexico, and Phoenix, Arizona. In Albuquerque, where alternative sources of water are *very* expensive, we find a wide range of incentive-based conservation programs as well as aggressive public outreach and education programs. In Phoenix, where alternative water supplies are relatively inexpensive, incentive-based programs have been rejected; the City relies solely on public outreach and education programs.

Examination of the manner in which these two cities have designed their residential water conservation programs provides a clear manifestation of the importance of a government giving close consideration to the benefits and costs associated with any particular conservation program design — the importance of considering the extent to which the expenditure of "cents" makes good public policy "sense." Such an approach is highly recommended by the U.S. Environmental Protection Agency and is a basic tool that has been used in U.S. cities whose conservation programs are widely recognized as being exceptionally effective. These observations then raise questions as to the efficacy of state-wide policies requiring, for example, restrictions on outdoor water use in <u>all</u> communities in a state. Our study suggests that Georgia's citizens may well be better served by the adoption of policies designed to "fit" the particular circumstances of water scarcity that is faced by communities affected by the policy.

A Case Study Approach

I. Introduction

The purpose of this paper is to invite Georgia policy makers — indeed the citizens of Georgia — to join us in a momentary pause for the purpose of reflecting on water scarcity in Georgia: what it means, and appropriate responses to it in terms of the adoption of water conservation policies aimed at residential water use. In this reflective discourse, we ask the reader to bear in mind that discussions of possible policy alternatives are intended to be just that: *possibilities* — actions that the state *might* wish to consider. Our intent is not to advocate any position or policy. It is simply to suggest lines of thought that might -- and we stress *might* -- lead to innovative ways for Georgia to deal with some of its water problems. Basic to the line of thought that we suggest is that Georgia may benefit by rejecting the "one-size-fits-all" approach to policy making.[1] Rather we argue that rational policy making requires that one assess the benefits of a policy as they apply to specific circumstances that exist in a community with the costs that citizens are asked to pay for the policy — that one match "good sense" with the monetary "cents" associated with the policy.

There are many ways by which residential water use can be reduced *via* conservation. The American Water & Energy Savers, Inc. web site lists 49 ways for doing so.[2] But while conservation options are many, it *may* be difficult to induce households to adopt them. Two, somewhat conflicting, surveys regarding the public's perception and response to the need for

[1] An example is the Georgia Environmental Protection Division's of a voluntary, state-wide program restricting outdoor water use. See "Georgians asked to restrict outdoor water use," release from the Georgia EPD dated May 21, 2003.

[2] Georgia's Pollution Prevention Assistance Division provides a comprehensive list of water conservation manuals and books, as well as water management/conservation websites. See www.ganet.org/dnr/p2ad/wcw-books.html, and .../p2ad/wcw-websites.html.

conservation are interesting in this regard. The first is a 2003 survey conducted by Georgia's Pollution Prevention Assistance Division[3] which found, among other things, (i) Georgia residents were more concerned with water quality than with water quantity; (ii) however, the Georgia public had positive attitudes toward the general need to conserve water and strongly supported the statewide conservation effort; (iii) the Georgia public identified, as primary water-using activities, taking showers, doing laundry, and washing dishes or other household items (seemingly unaware of the major use: toilet flushing); and most interestingly, (iv) that Georgia residents *are already undertaking and are likely to undertake a variety of water conservation measures*.

These finding are in sharp contrast to results from an on-line poll conducted by the Georgia Conservancy. The poll asks: "what do you do to conserve water?" As of December 29, 2004, the results from 5,531 respondents were:[4]

*install low flow plumbing fixtures	0.0%
*turn the faucet off while brushing your teeth or shaving	0.5%
*take short showers instead of baths	0.3%
*all of the above	3.7%
*none, we have plenty of clean water in Georgia	**95.5%**

Differences in these two polls/surveys aside, there is general agreement concerning the need for state water authorities, as well as community water managers, to understand water conservation alternatives and, most importantly, understanding which alternatives can be made

[3] Georgia Department of Natural Resources Pollution Prevention Assistance Division, "Understanding the Georgia public's Perception of Water Issues and the Motivational Messages to which they will respond," Final Report (Atlanta: 2003).

[4] See http://www.georgiaconservancy.org/WaterQuality/WaterQuality.asp.

to work. In these regards, we note the difficulties (possibly reflected in the Georgia Conservancy poll) and critical importance of "selling" the need for water conservation to a public that is exposed to drought only periodically.

The critical importance for inducing communities -- stakeholders -- to "buy in" to any conservation program -- for the program to be viewed as credible to those affected by the program -- lies at the heart of general "guiding principles" for a successful conservation program identified in a recent study conducted under the auspices of the Georgia Conservancy.[5] This study, based on discussions and interviews with directors of twelve programs that have enjoyed notable success in the states of Arizona, California, Florida, Maryland, Massachusetts, New Hampshire, New Mexico, North Carolina, and Oregon, as well as local regional programs in Albuquerque, N.M., Cary, N.C., and Phoenix, AZ, develops eight elements for a successful program, the following three of which relate to the importance of the public's acceptance of a program as being credible and relevant to their circumstances:[6]

* Acceptance and aggressive support by political leaders is essential;
* A strong educational and media outreach program is required.
* Stakeholder involvement in the planning and implementation process is essential.

At the local, community level it is necessary to move beyond (or more precisely, within the context of) principles noted above to the choice of specific programs and activities that will

[5] Schmitt, Mandy, Alice Miller Keyes, and Jessica Walters, "Meeting Water Supply Needs While Protecting the Economic and Ecological Integrity of Georgia's Water Resources, available (as of August 10, 2004) on the Georgia Conservancy web site (8 pp.).

[6] Schmitt, et al.'s remaining "principles" are: a detailed water supply and conservation policy is required to guide local, regional entities to adopt conservation practices; comprehensive monitoring of water use and water levels is required; a stable and non-politicized funding source for local water supply and conservation programs is essential; a statewide water conservation plan must have a sufficient number of qualified personnel; and the state must provide local water conservation programs with competent technical assistance. *Ibid.*

provide the substance for a conservation program.[7] As mentioned above, there are many ways that a household can conserve water. A community can adopt programs designed to inform the public of the importance of conserving water, along with a description of means by which water can be saved -- e.g., shutting off water while brushing teeth. This is the stuff of educational and outreach programs. Alternatively, or in addition, a community can adopt pro-active programs that provide incentives for households to conserve water: provide rebates for the installation of low flow toilets and other water fixtures; rebates for households switching to xeriscaping.

However, incentive based programs to promote conservation requires in-depth analyses of benefits and costs, among other considerations. Thus, one of the U.S. EPA's Water Conservation Guidelines, "basic steps" is: analyze benefits and costs.[8] As an example in these regards, the South Florida Water Management District emphasizes the notion that "conservation programs should have a mix of *incentives* and *measures*."[9] Financial *incentives* require the expenditure of community funds. Among the more important *measures* is benefit-cost analysis -- analyses of the extent to which the program results in significant water savings. These two considerations are seen in criteria used by Cary, North Carolina, one of Schmitt, Keyes, and Walters' "success stories," for choosing elements of their water conservation plan. Criteria used by the Town of Cary, North Carolina for the design of their water conservation program were:[10]

---

[7] The State of Florida recently completed an elaborate process involving the State's Department of Environmental Protection working closely with the state's five, locally-managed, water management districts resulting in a "Joint Statement of Commitment" which is a written agreement by key public water supply partners to collaborate on measures to improve water use efficiency. See mailhtm1:mid://00000889/, last updated 12/10/04.

[8] U.S. Environmental Protection Agency, *Water Conservation Plan Guidelines*, at p. 17 (Washington, DC: August 6, 1998).

[9] Power point presentation prepared by the South Florida Water Management District, available on the Georgia EPD web site.

[10] Executive summary in "Water conservation & Peak Demand Management Plan (adopted April, 2000)," Town of Cary, North Carolina, at p. iv.

* benefit-cost ratio greater than 1.0 (i.e., the program must save more than it costs)
* reasonable cost (i.e., affordable)
* significant water savings
* acceptable non-quantifiable impacts.

The importance of matching "sense" and "cents" is most effectively seen within the context of actual applications. To this end we present two case studies of conservation programs adopted by two cities wherein economic considerations led each city to adopt very different types of programs. The cities to be studied are Albuquerque, New Mexico, and Phoenix, Arizona. As will be shown, the costs of additional water supplies in each of these two cities is very different: $5,000 to $6,000 (or higher) per acre foot in Albuquerque, less than $2,400 per acre foot in Phoenix.[11] Such cost differences result in very different conservation programs: primarily education/outreach programs in Phoenix; education/outreach programs *plus* a wide variety of rebate programs in Albuquerque. We begin in section II with a description of the program adopted by Albuquerque, and the rationale which led the city to its choice of a particular policy design. Attention is then focused on Phoenix, Arizona, in section III. Concluding remarks are offered in section IV.

The reader should note that this report does not address two kinds of conservation programs that can be very important for a communities conservation efforts: the use of conservation pricing and the adoption of programs designed to mitigate water losses ("unaccounted for water") from leaks in the water distribution system. Given the complexities associated with these kinds of programs, they are considered separately in companion studies

[11] Implied by the rejection by Phoneix of toilet rebate programs, which may "earn" some an acre foot at a cost of some $2,400, on the grounds that such savings are more costly than the cost of additional water supplies.

published under separate cover.[12] For the reader's interest, however, we point out a few facts developed in these works that are of direct relevance for any consideration of water conservation programs. Our research indicates that 70 billion gallons of water pumped annually by the Georgia's municipal water systems (16% of the total) is non-revenue water. A gallon of water supplied by a municipal water system in Georgia costs the household consumer approximately $2.60 per 1,000 gallons and therefore, Georgia water systems are foregone $182 million/year in revenue because of water losses (among other elements of non-revenue water). Given current pricing policies, the 440 billion gallons of water for residential use by municipal systems in the state is priced at $1,144,000,000. A conservation-pricing policy that increased prices by 10% would then cost consumers about $114 million. But this 10% price increase, according to our preliminary estimates, would reduce residential water use by only some 2% to 4% — implying a cost of between **$6.48 and $12.95** per thousand gallons saved. To put this in a comparative benefit-cost context, Albuquerque's toilet rebate program saves water at a cost of about $7.35 per 1,000 gallons.[13]

II. The Albuquerque Conservation Program For Residential Water Use.

[12] See Ronald Cummings, Nancy Norton, Virgil Norton, and Douglas Wilson, "Unaccounted-for Water In Georgia's Urban Areas: An Exploration Of Policy Issues," Georgia Water Planning and Policy Center Working Paper #2004-008, January 2005; and Ronald Cummings, Nancy Norton, Virgil Norton, Mary Beth Walker, and Douglas Wilson, "Conservation Pricing of Household Water Use in Georgia Communities: A Preliminary Exploration," Georgia Water Planning and Policy Center, Working Paper #2004-011, July 2004.

[13] The toilet accounts for about 43,490 gallons per year of a typical household's water use. According to a GAO report (GAO/RCED-00-232 report dated August 31, 2000) low-flush toilets reduce water use for flushing by 40%, or by around 17,000 gallons per year. The Albuquerque rebate for replacing toilets (discussed below) is $125.00, implying the saving of 17,000 at a cost of $7.35 per 1,000 gallons.

Albuquerque has always relied on ground water for it's municipal and industrial (M&I) water needs.[14] Rapid population growth during the 1950s and 1960s gave rise to concern with the management of the underlying aquifer supplying the city's water supplies. A model of the aquifer, developed by the State Engineer's Office (SEO) with the U.S. Geological survey assumed that water from the Rio Grande — which flows through the city — seeped rapidly through deep, relatively uniform layers of porous rock, sand, and soil through much of the basin. Thus, it was concluded, Albuquerque's ground water supply is virtually unlimited inasmuch as the more that the city pumped, the faster seepage into the aquifer would occur thereby "replenishing" the pumped groundwater. Given that water in the Rio Grande is fully appropriated (all water rights have been established), the SEO developed a formulae designed to "keep the river whole." This formulae defined the reductions in river flow that would be attributed to the city's pumping. To offset these reductions, the city would need to acquire existing water rights which would be retired as pumping required their use to protect the river. The city acquired some 23,000 acre feet (af) by purchases from private individuals, and another 48,200 af was "purchased" via its participation in the San Juan Project, constructed by the Bureau of Reclamation, which transfers New Mexico's share of the Colorado through 26 miles of tunnels under the Continental Divide into the Rio Grande Basin. Offsetting the effects of the City of Albuquerque's pumping, these rights, which could be used to supplement Rio Grande flows, were thought to be sufficient to serve the city's water customers in the 1990s and beyond. As these supplies became exhausted, the city could acquire additional water rights through the

[14] The following discussion of the evolution of Albuquerque's water issues draws from Albuquerque's current water plan, "AWRMS Evaluation of Alternatives and Strategy Formulation," pp. 1-1 through 1-6, March 1997.

purchase of rights from existing rights-holders.

In the 1980s, however, it became apparent that something was wrong. The aquifer had begun showing losses through declining water tables. Moreover, as water levels declined, so did water quality. In 1988, the city, along with the U.S. Geological Survey, initiated a new series of studies of the aquifer that included a much larger area than initial studies. By 1993, it became apparent the way that the aquifer "works" is much different than it had been previously assumed.[15] The aquifer was shown to be smaller and much less unified than previously assumed, and it consisted of geologic materials that made the extraction of water more difficult. Most importantly, geologic faults and other irregularities were discovered that effectively formed barriers that prevent water from spreading; the aquifer's connection to the Rio Grande was much more complex and limited than it was earlier supposed.

In short, the city finds itself facing dual problems. It cannot rely upon ground water as a sustainable source. Continued reliance on the aquifer will ultimately deplete the resource, as well as introduce serious water quality problems associated with arsenic concentrations. It cannot rely exclusively on surface water. Notwithstanding the 71,200 af of water rights that it owns, water "rights" are of little use during periods of sustained drought such as the city has faced beginning in 1999 and continuing as of late 2004. If there are no waters in the reservoirs that, along with melted snow pack, feed the river, the right to water is an empty right.

In response to these conditions, the city has adopted a broad strategy for water

---

[15] See, as examples, U.S. Geological Survey, *Geohydrologic Framework and Hydrologic Conditions in the Albuquerque Basin, Central New Mexico* (1993), U.S. Geological Survey, *Simulation of Ground-Water Flow in the Albuquerque Basin, Central New Mexico 1901-1904, with projections to the year 2020* (1995), and U.S. Bureau of Reclamation with the New Mexico Bureau of Mines and Mineral Resources, *Middle Rio Grande Water Assessment* (1997).

management that has many components. Among the more important of these components are the following: construction of water treatment facilities that will allow the city to obtain its water from the river during periods when river flows are sufficient for this purpose; preserve the aquifer for use during periods when river flows limit, or do not allow, the use of surface waters;[16] explore means for enhancing ground water recharge through recharge trenches and other means; give strong emphasis to water conservation.

Presently, the city pumps 110,000 acre feet per year (almost 100 mgd) from the aquifer, about half of which is believed to be replenished by river water. About 55,000 af is returned to the river as treated waste water. Thus, while the river "deficit" is likely small (almost 55,000 acre feet reduced by aquifer replenishment less the return of some 55,000 acre feet of treated water), the aquifer is being mined by some 55,000 af per year — a level of mining which cannot be sustained.

Under conditions such as these where "additional" water supplies, especially during periods of drought, would be enormously expensive if not impossible to obtain, it should not be surprising that the structure of Albuquerque's water conservation program is very broad ranging, including educational/public outreach programs (comparable in many ways to that seen in Phoenix discussed below) and an ambitious rebate program. Albuquerque offers financial incentives for almost *any* manner in which households might conserve water. Consider the following range of public and private conservation programs put in place by the city:

> 1. rebate for the installation of low-flow toilets: $125.00 for one toilet, $75.00 for a second, and $50.00 for a third. Non-residential customers receive $90.00 per toilet for any number of replaced toilets.

[16] The city is considering the construction of an adjustable-height dam upriver from its point of diversion in efforts to extend the period of time during which flows can be used for water supplies.

2. rebate for the installation of low-flow shower heads: $8.00.

3. rebate for low water-using dishwashers: $50.00.

4. rebate for the installation of multi-setting sprinkler timers: $10.00

5. rebate for the purchase of a hot water recirculating system: $100.00.

6. rebate for the purchase of a rainwater harvesting barrel (1,000 square feet of roof water collection surface with an inch of rain yields 600 gallons of water): $25.00.

7. rebate for xeriscaping: residential customers, up to $800; business, up to $5,000.

8. free water audits: home's water use patterns and billing reviewed; leak checks conducted for water meter, toilets, landscape/sprinkler systems. The audit includes free installation (free devices are provided if existing fixtures are less efficient) of 2.5 gpm shower heads; high-efficiency faucet aerators; auto-shutoff hose nozzles; and toilet fill tube diverters or displacement device.

9. water conservation contests in which neighborhoods can win up to $10,000.00.

10. initiated (in 2004) a $3 million-plus program to reduce leaks in the city's water system.

Figure 1
Albuquerque Rebate Programs: Low Flow Toilets and Washing Machines

Since Albuquerque's conservation program began in

1995, over 50,000 high flow toilets have been replaced with low-flow toilets and more than 6,000 high water-using washing machines have been replaced; some 2,000 high water use landscapes, representing almost 3 million square feet, have been converted to xeriscapes; and some 9,000 residential and 23,000 multi-family customers have taken advantage of the city's free water use audit and retrofit program. Over the period 1995 through 2003 water use in the city has fallen from 250 gpcd to 193 gpcd (175 gpcd when unaccounted-for-water is deducted).

We have been unable to acquire data that would allow for a credible estimate for total costs of Albuquerque's conservation activities over the 1995-2003 period, which might then be used to assess benefits and costs associated with their programs. Simply for the purpose of obtaining some insight into the cost-effectiveness of Albuquerque's programs, however, if the replaced toilets, washing machines are costed at their maximum costs, the 2,000 xeriscapes are costed at $400.00 each, and the 32,000 audits are costed at $50.00 each (two hours of labor at $20.00/hour plus $10.00 for devices), the city would have spent some $9.2 million for these programs between 1995 and 2003. If the water savings of 57 gpcd is in some substantial part attributable to these programs, the city's conservation program would have effectively "bought" some 30,000 acre feet of water at a cost of about $304/af.

The point that we wish to emphasize in this brief overview of Albuquerque's residential water conservation program is that virtually all of these program elements, even those that may seem to be costly, can truly make good send in an environment where the City would have to pay amounts in the range of $5,000-$6,000 per acre foot of newly acquired water rights.[17] This is to

[17] Information provided by the Albuquerque Conservation Department. This price range is for water rights with a pre-1907 priority date, *if* such rights could be obtained. The City has had little success in finding sellers of such rights, however, which could imply a much higher "real" market price for such rights.

say that a lot of “cents” makes good sense in the case of this City.

III. The Phoenix Conservation Program For Residential Water Use

The water supply situation and the related residential water conservation programs in Phoenix, Arizona, contrasts sharply with that seen in Albuquerque. The Phoenix public water

supply system provides water for approximately 1.4 million people in 2003; unlike Albuquerque, which has historically relied on groundwater, about 95% of Phoenix's water supply comes from surface water. The City is fortunate in having purchased rights to considerable quantities of surface water in the Salt, Verde, and Colorado Rivers, water which is delivered to the City *via* the Central Arizona Project (CAP) and the Salt River Project (SRP). They currently have some 40,000 acre feet of water that is available to them each year that they are not using.[18]

The City adopted a water conservation plan in the early 1990s following a comprehensive study of the costs and water savings of alternative components of a water conservation plan for residential water use. The City considered the use of rebate programs, such as paying rebates for the replacement of high flow toilets. Their study of alternatives resulted in their rejection of rebate programs, and their adoption of a conservation program based strictly on public outreach and education. The rationale for their rejection of the use of rebates is seen in the City's public education materials in response to a frequently asked question exemplified by the following: "I have a friend who lives in San Antonio, Texas who bought a 1.6 gallon toilet and the San Antonio water department gave his a $75.00 rebate...I am just curious why Phoenix of all cities does not provide rebates?"

> "There are several reasons, but the primary one is that such a payment would exceed the value the city would receive from making it. That is, we would not see $1.00 worth of savings for each $1.00 spent...***San Antonio's water supply situation...is different from Phoenix's***.(emphasis added)[19]

It is useful for our inquiry as to how a city makes "sense" out of "cents" to gain deeper

---

[18] Email from Mr. Thomas Babcock, Water Conservation Coordinator, Phoenix Water Services Department, Phoenix, August 30, 2004.

[19] City of Phoenix, "Water and Wastewater Frequently Asked Questions,"

insights as to the considerations leading Phoenix to reject rebate programs, relying solely on public education programs. Such insights are gained from a consideration of an explanation of Phoenix's current thinking explained by Mr. Thomas Babcock in response to questions to him posed by the authors. The reader should note the strong emphasis placed on cost/benefits analysis — in a sharp focus on efforts to make economic sense out of a program.

> "When last we examined toilet rebates we concluded that the maximum amount we could give out for a rebate was $60.00. Above that we were "buying" water at a price higher than our most expensive alternative source of water...We not only have to look at the rebate value of removing old toilets but also the administrative costs, and the verification process. Also, we want to find a use for broken or crushed older toilets rather than having them take up landfill space...All of this adds cost to such a program. Those costs have to be factored into our cost/benefit analysis...One of the things that has struck me every time we address this issue is the question of 'free riders.' 'Free riders' are those who will take an action without a rebate offer, but who will take the rebate anyway if one is offered. It is only human nature. If we were to offer a rebate it would be for the express purpose of creating an incentive for someone to take action they would not have taken otherwise — it should be an incentive for a significant conservation action, not a reward for what the individual was going to do (or had to do if the toilet is broken) anyway...When we last evaluated toilet rebates, we evaluated what several other cities had done and found there were glaring loopholes in all of them. The cities were not breaking even on the program or were not following up to see if old toilets were destroyed instead of being re-sold and put back in service in the same area. In Tucson there was a very lucrative market for old toilets and most or all of the incoming stock was toilets which had been removed for a rebate."[20]

If a low-flow replacement toilet saves 6.4 gpcd, and the toilet serves a household size of 2.7 persons, the replaced toilet would save about 15,374 gallons per year, or .05 acre feet. With a

[20] Email from Mr. Thomas Babcock, *Op. Cit.* August 30, 2004.

Figure 2
Outreach Programs In Phoenix: Examples of Publications

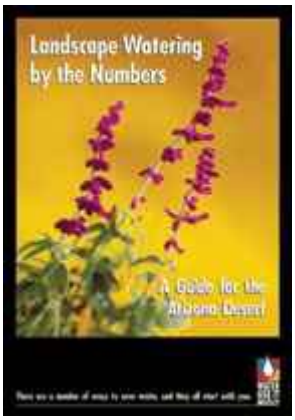

Figure 3
Phoenix Outreach Programs: Education

For kids

For teachers

"Where does our water come from?"

rebate cost of $60.00, the rebate would be tantamount to "buying" an acre foot of water for approximately $1,200. As noted above, $1,200/af is a bargain for cities like Albuquerque that must pay $4,000 to $6,000 an af for new water rights. Apparently, Phoenix can draw on its supplies for well under $1,200[21] — thus their rejection of rebate programs. Mr. Babcock advises us, however, that given the extended drought faced by the Western U.S. over the last five years the City is reassessing the possible use of rebates. "By next Spring, we will either have a rebate program in place, or we will have determined it is still not cost beneficial and will have chosen not to do this. I cannot, at this, time, tell you which is the more likely."[22]

Thus, the residential water conservation program in Phoenix is based solely on education and public awareness. Components of this program include: school education programs, grades K-12 plus college-level curricula; residential education programs, involving such things as homeowner irrigation classes, landscape workshops, and distributing educational materials at neighborhood fairs; non-residential workshops and seminars; education programs for professional gardeners and landscape companies; site visits and the provision of technical assistance.[23]

This education-based program appears to have enjoyed remarkable success, with water use declining some 25% between 1990 and 2003, from about 226 gpcd to present levels of 170 gpcd. This success may be viewed as a reflection of the existence, in Phoenix, of key elements

[21] The Arizona Water Company, which provides water for communities outside of Phoenix has a water availability fee of $1,350 per acre foot (www.azwater.com/wa-261.html), still well below prices faced by Albuquerque.

[22] Babcock, *Op. Cit.* August 30, 2004.

[23] See Table 4 in City of Phoenix, "Water Conservation Plan 1998," Water Conservation Office, Phoenix Water Services Department.

of a successful conservation program noted by Schmitt, et al.[24]: strong support by political leaders and a strong education and media outreach program.

[24] Schmitt, Mandy, Alice Miller Keyes, and Jessica Walters, "Meeting Water Supply Needs While Protecting the Economic and Ecological Integrity of Georgia's Water Resources, available (as of August 10, 2004) on the Georgia Conservancy web site (8 pp.).

IV. Concluding Remarks

"Water scarcity" can take on different dimensions in different regions of the U.S. and, indeed, in different water basins within a single state. For example, in Cary, N.C. water scarcity arises because the city does not have in place sufficient infrastructure to meet the city's needs, particularly during summer months. Capital investments required to expand infrastructure are, of course, expensive. Water conservation allows the deferral of that investment, and the city saves *scarce funds*. Thus, a primary purpose for Cary's conservation plan was "...savings associated from the deferral of capital projects that would otherwise have been necessary in the absence of conservation."[25] We will refer to this motivation for water scarcity as "financial water scarcity."

On the other hand, in Western States "water scarcity" takes on a very different character. Here "water scarcity" refers to the absolute scarcity of water per se -- i.e., there are typically limited quantities of unappropriated water that can be tapped to increase the water supply of any user. If any new or existing water user wants additional water supplies, they must obtain them by purchasing water rights held by others. The cost of water rights in Western States (in 2000 dollars) averaged about $1,218 per acre foot over the period 1990-2000,[26] ranging from as low as $38.00/af to as high as $4,611/af (as noted above, $5,000-$6,000 in Albuquerque in 2004).[27] Costs of water will vary from one Western city to another. As we have seen in the examples of

---

[25] *Executive summary* in "Water Conservation & Peak Demand Management Plan (adopted April, 2000)," Town of Cary, North Carolina, at p. iv.

[26] Table 1 in Czetwertynski, Mariella, "The Sale And Leasing Of Water Rights In Western States: An Overview For The Period 1990-2000," Environmental Policy Program, Andrew Young School of Policy Studies, Water Policy Working Paper #2002-002 (Atlanta: 2002).

[27] In both instances here the price cited is technically for a "share" of water which could be one acre foot or any other number. The value of the share depends on the amount of water available to the fixed number of shares.

Phoenix and Albuquerque discussed in this report, such differences in costs can result in very different designs for conservation programs designed to deal with water scarcity.

What does "water scarcity" mean in Georgia? Actually, the response to this question may vary considerably from region to region within the state; it depends on the part of the State that is of interest. In parts of the state where there is (or will be) a permanent cap on water use permits, finite water scarcity, similar to that seen in Western states, is an issue. On the other hand, in other parts of the state, where populations are growing rapidly but water use permits are not permanently capped, financial water scarcity may be an issue. In still other parts of the state where neither permit caps nor rapid population growth exist, water scarcity is not an issue.

Thus, the term "water scarcity" can mean many different things in Georgia, depending on what part of the state is of interest. Given this variability, the important questions to consider becomes: how does one shape water conservation programs affecting the many towns and villages in the state? Do we have single policies that apply with equal effect in all locations? Or should we attempt to match policies with the conditions of water scarcity relevant for each area? Our case studies of Phoenix and Albuquerque suggest that the latter approach may be the most rational one: an approach based on the cost-effectiveness of program elements -- one that attempts to make "sense out of cents."