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## **URBAN WATER PRICING: A HISTORICAL PERSPECTIVE AND THE CHALLENGES FOR THE FUTURE**

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The work that I am going to talk about is really a combination of efforts, and I would be remiss if I did not mention some of the people or groups who have contributed to this work. Part of this is research that I have been doing on my own. Part of this work is with SAHRA, which is an NSF funded science and technology center housed at the University of Arizona. Part of the work is by an intern sponsored by the Office of the State Engineer who is working with Anne Watkins on an infrastructure initiative. There is a whole consortium of people working on urban water pricing. For any errors I, of course, take responsibility.

There is a quote from Mellendorf in 1983, which is still fairly germane to water. The part that is most important says that water seems to almost have these sacred qualities that precludes it from economic analysis. This is important because of the history of water and water pricing. Unfortunately, water becomes scarcer as the population grows, but there haven't been drastic changes in the price of water. As can be seen from the previous talk by Jim Peach, population growth is going to occur and water issues are going to become more difficult. Perhaps economics can at least lend some analysis and some tools that might help. If water

is becoming scarcer, are pricing policies a viable tool to help manage water?

What characterizes the Southwest? I am preaching to the choir, because you know that we have had growing populations. If you look between 1990 and 2000, the South-

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west was part of the United States that was the fastest growing over that period of time. We have erratic precipitation. If we look at the amount of precipitation we get in the Southwest and in New

Mexico specifically, it is very, very low. All of these things are going to make this a difficult thing. If we look at the increase in competing uses, we find that not only do we have increases in demands, but we also have increases in non-market uses. We have increases across the board.

If we look at the report Water 2025, which DOI put out in 2003, we find some potential areas of conflict (Figure 1). You probably have all seen this, but if you look at the map of the Four Corners Area and New Mexico specifically, red shows the highest potential for conflicts. I think something that might actually be more frightening to me is a survey by the U.S. conference of mayors, which surveyed 414 cities. They looked at what the water concerns were. There was a top ten list. Included in the top-ten list was the age and security of infrastructure. The water supply availability, unfunded federal mandates, drought management, and regional conflict over water use were also on the list. It sounds like a shopping list for New Mexico. I think what probably caught my eye the most was that forty percent of the cities said that they did not have an

adequate water supply in twenty years. That is a fairly significant statistic.

How do water prices fit in here? We must consider the historical realities of where water prices have been, how they impact where we are right now, the current trends in water prices, and what we might expect in the future. Are we going to have to change what we are doing, and how we are doing it in order to have supply and demand be at a point where the demand does not exceed the supply available? The conventional wisdom has been that people do not respond very much to price, in fact people are very unresponsive to water price. Why do we say this is the case? Basically, it is because of the data. The empirical evidence from studies done between about 1950 and 1995 found that in every case consumers were unresponsive or were inelastic to price increases.

Why is this the case? We have to look at historic pricing in the United States (Figure 2). Across the United States from about 1955 to 2000, you see a price per gallon ranging from .0005 cents up to about .0043 cents per gallon. It does not matter what part of the United States we are in or what year we are in. There was very, very little difference in the price plotted across time and geographic area. What does that mean? It means that it was a statistically insignificant difference between 1955 and 1995 in the prices we were paying for urban water. What is the problem with that for where we are now and where we are going in the future? Historical data indicates little response to water price increases, but the historic prices may not reflect current or future reality.

Do prices matter today? They are somewhat higher than the historical prices. Look at urban prices today (Table 1) and the cost of six thousand gallons of water for May 2004 from a survey done by the NM Environmental Department. Alamogordo cost for six thousand gallons of water is about \$16.61. Aztec has the lowest cost at \$6.36. Albuquerque's price was about \$17.94. Las Cruces' price was \$14.68. These

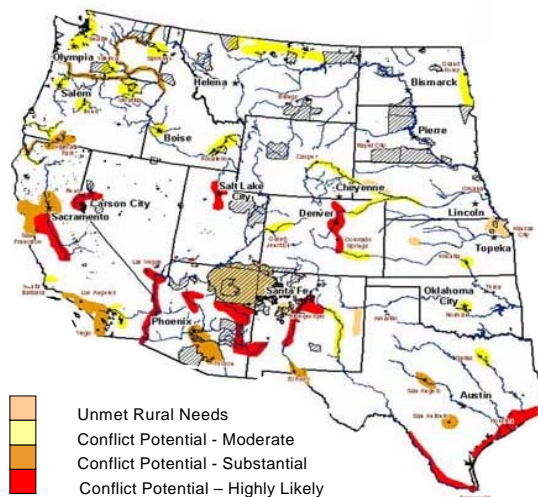


Figure 1. Potential Areas of Conflict (2003)

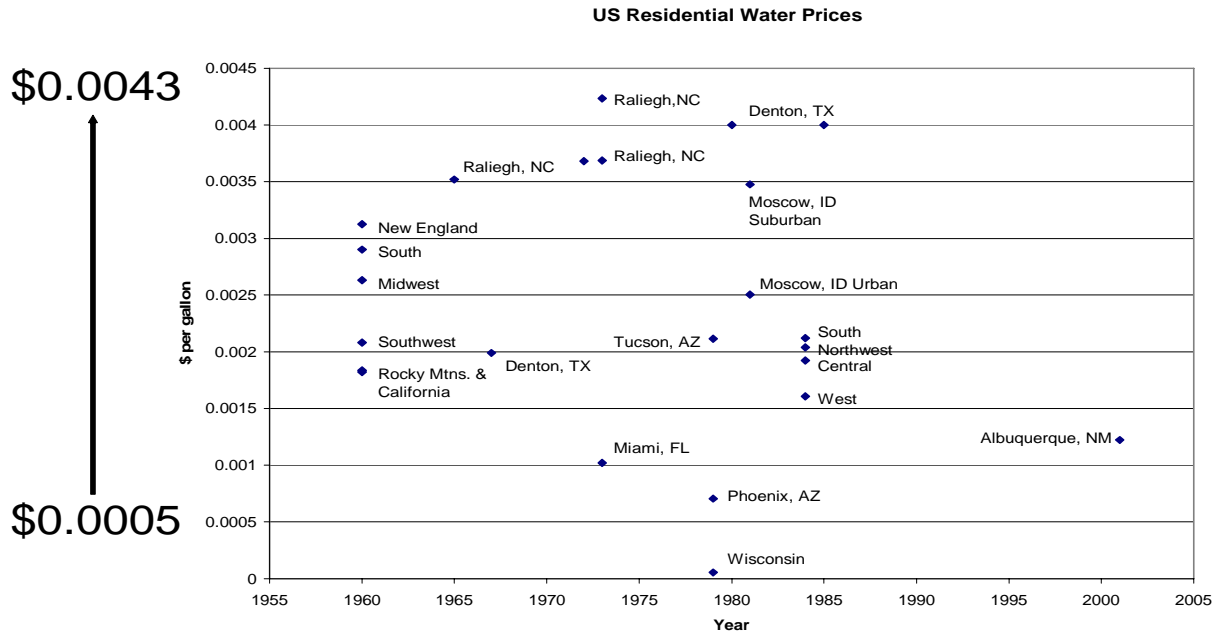


Figure 2. Historical Pricing in US

range anywhere from six dollars up to about sixty dollars. The average is about nineteen dollars. Think about what nineteen dollars buys. Nineteen dollars buys a family of four a meal at McDonald’s, or seven coffee drinks at Starbucks. It does not buy very many bottles of water. What are the prices reflecting today? What is the signal that is being given? If the prices reflect scarcity or true value, the incentive and the prices or the information being given may not be the appropriate information.

Table 1. Do Prices Play a Part Today in the SW?

Cost for 6000 gallons of water (May 2004):	
Alamogordo:	\$16.61
Albuquerque:	\$17.94
Aztec:	\$ 6.36
Bernalillo:	\$20.48
Carlsbad:	\$ 9.91
Las Cruces:	\$14.68
Avg: \$19.39, Min: \$6.36, Max: \$61.14, Med: \$18.00	
From: NM Environment Department Water and Wastewater User Charge Survey	

How important is this? For any of those of you who have read *Freakonomics*, which is one of the books on the best-seller list right now, there is an anecdote about a couple of economists who did a study on daycare. They went to Israel and looked at nineteen different daycares. The average cost per month of keeping your kid in daycare was about \$360. On average across these nineteen daycares, there were about eight late pickups per day. At that point, there was absolutely no penalty for being late to pick up your child. The economists got the daycares to implement an incentive for late pickups. Every time someone was late they were charged a three-dollar late fee. What happened to the number of late pickups? It went up to twenty across the board. A wrong signal is perhaps worse than no signal. That is the wrong signal, because now it is said that the value of the daycare’s time for picking up a child late is three dollars. They removed the three dollars and went back to just \$360 a month. What happened? They stayed at twenty late pickups per daycare. People take information from that incentive. They learn from it, and they use it.

What are the incentives we are giving? Almost everyone has a base or fixed charge. There is a commodity charge added on to that for the amount of water that is used. Some places are using block rate structures, where if you use more, you pay an increasingly higher commodity charge. Summer

surcharges are also being used. There is one thing that I will say about the base charge which makes it difficult to analyze and compare across different communities: when you have a small base that is paying that fixed charge for just the maintenance what ends up happening is these systems, in many cases, have a higher overall cost than larger places like Albuquerque. One of the things that this does not probably bode very well for small community water systems is if they need more money for infrastructure. If they increase their base charge they are going to experience difficulties because of what that will do to their consumers. Perhaps in these cases, one of the things to consider is regional water systems that spread the costs over a larger consumer base.

**The trend in the United States and the trend in New Mexico is that persons per household have declined dramatically from 1970 to 2000.**

What are some pricing examples in the Southwest? Table 2 shows prices from Albuquerque, Santa Fe, and a few other places. If you will notice in almost every case there is a base charge that goes anywhere from about \$3 up to \$12 in Santa Fe. They have different commodity charges, and they may have surcharges or block rates. Albuquerque has a surcharge in the summer that is equal to fifty percent of the commodity charge if you use more than three hundred percent of the city average. If you go up to four hundred percent of the city average, the surcharge goes up to one hundred percent of the commodity charge. The summer runs from April through October. Santa Fe probably has one of the most aggressive policies right now. It costs \$2.50 per thousand gallons between 12,000 and 20,000 gallons, and then it increases. Their drought policies are fairly steep and substantial. It costs up to \$25 per thousand gallons if you use over 20,000 gallons of water. They are becoming very aggressive in what they are doing. Truth or Consequences has a block rate as well as Denver, Tucson, Fort Collins, and Las Vegas. Los Angeles is interesting, and I am using this example for a reason. They actually have a tiered system that depends on where you live and the size of your household. They started to recognize that there is heterogeneity across households in Los Angeles, which is a very progressive way to price.

Table 2. Southwest Pricing Examples

Location	Base	Commodity (1000 gallons)	Comments
Albuquerque	\$4.60	\$1.65	Surcharge
Santa Fe	\$12.42	\$5.47	Surcharge
T or C	\$8.15	\$1.75	Block Rate
Denver	\$3.41	\$1.63	Block Rate
Fort Collins	\$12.72	\$1.78	Block Rate
Tucson	\$5.35	\$1.03	Block Rate
Tucson	\$11.96	\$1.98	Block Rate
Phoenix	\$5.16	\$1.93	Uniform
Las Vegas	\$3.72	\$1.05	Block Rate
Los Angeles	None	\$2.46 (tier 1) \$2.56 (tier 2)	Block Rate, by tier by month

What do we need to consider for future prices? We need to consider infrastructure needs. The EPA did a survey a couple of years ago in which they looked at the infrastructure needs and found that we had huge shortfalls in the United States across every state. Supply availability and population growth are also considerations. What we need is really to be able to look at both the supply and demand part of this. What about New Mexico? According to the EPA survey, our current, largest needs are transmission and distribution. Figure 2 depicts results of a survey of community and other water systems. The largest future need for New Mexico is treatment, according to the survey. The problem is that federal dollars are declining. We are not going to be able to pay for what we need.

Population growth is another huge concern (Table 3). The question is asked, "Where is the growth in our curve?" This is from the Bureau of Business and Economic Research at UNM. Bernalillo County and Albuquerque are going to grow. Doña Ana County is going to grow about 45%. Valencia and around Socorro are going to grow about 68%. Sandoval and Rio Rancho's projected growth is 82% between 2005 and 2030. With those increases, we have some difficulties in terms of where the water comes from and what we are going to do with that.

Table 3. Population Growth (2005-2030) BBER Projections

New Mexico: 33%
Bernalillo: 27%
Dona Ana: 45%
Santa Fe: 57%
San Juan 27%
Sierra: 50%
Valencia: 68%
Sandoval: 82%
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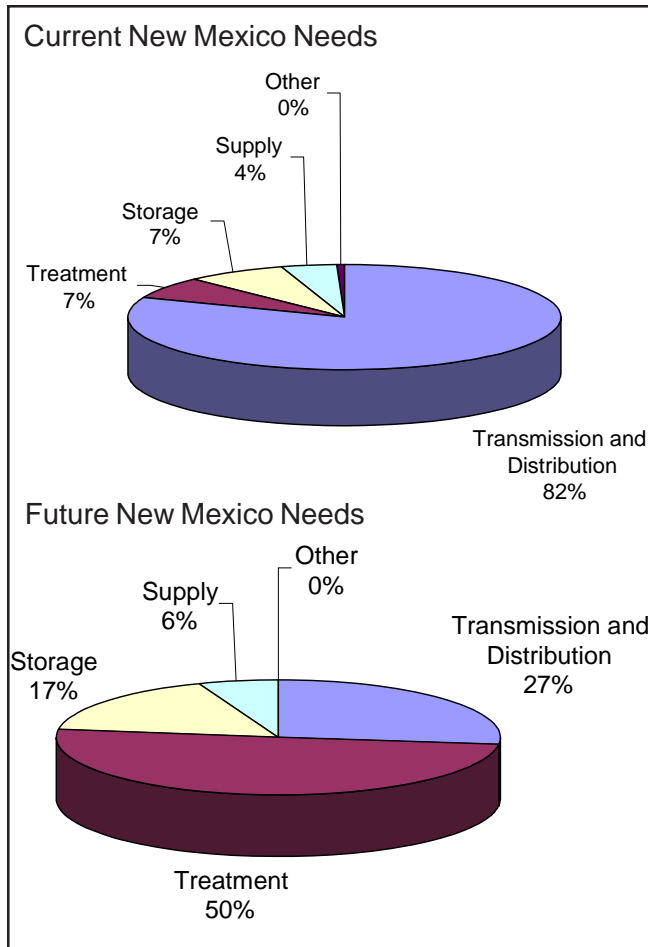


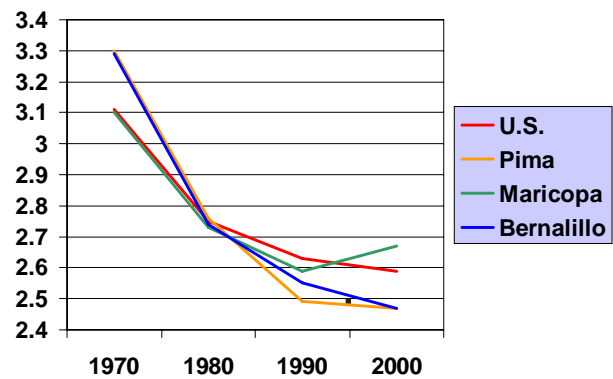
Figure 2. New Mexico Future Infrastructure Needs

One of the things that I want to talk about a little bit is industry in New Mexico. We are talking in the urban areas about economic growth. If you look at this, we can look at the macro economy and all the industry, but what is really important is where the water demand is. The demand is residential, commercial, and industrial. In Albuquerque, industrial water is less than five percent of the total water use in the city. Residential use is about 61%. Commercial is the rest of that. What is important about that? It is important because I would argue that all growth is not created equal. Table 4 is a chart that takes information from a Carnegie Mellon website that looks at the impact of a one million dollar increase in production in different sectors. I picked a couple of activities that are present in New Mexico. The fifth column over shows the impact of the dollars of gallons of water gained from the specific activity. It goes anywhere from ten cents per gallon for grain production up to about ninety-five cents per gallons for electronics. The third row over is the employment

that is required for that million dollar primary impact by the primary and secondary. For grain, the estimated employment increase is nine workers, for electronics, it is 20 workers. The employment numbers and their impact on population and the subsequent impact on residential consumption, I think, is what we really need to be considering rather than just how industry impacts water use. Economic growth and its impact on population, I would argue, is going to be very important.

All households are also not the same (Figure 3). The trend in the United States and the trend in New Mexico is that persons per household have declined dramatically from 1970 to 2000. We went from about 3.3 people per household in Bernalillo County down to less than 2.5. The impact on housing demand in Albuquerque is fairly consistent with other areas in New Mexico. These statistics are, by the way, from the work of Gary Woodard from the University of Arizona. In New Mexico during this time, 57% of housing demand is from population growth. 43% of the housing demand is because we like to live alone. The type of home ownership also matters. Single-family houses use more water than condominiums. Condominiums use more water than apartments. Owner occupied houses, we have found in some areas, tend to use greater amounts of water than non-owner occupied houses. The change in the housing stock mix impacts water demand per household.

Figure 3. Trends: Persons Per Household



from Woodard (2002)

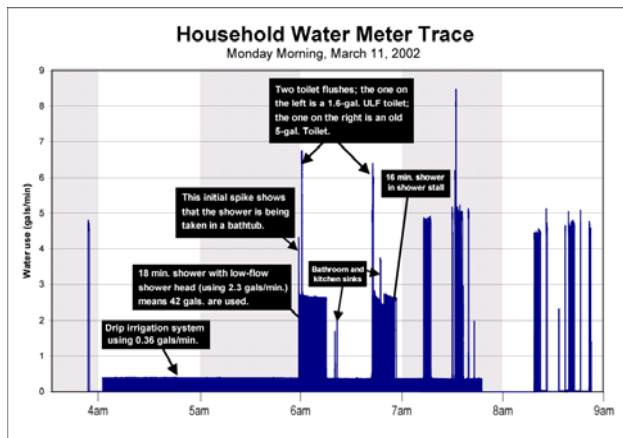
Another point to consider is whether conservation-built homes help. If you build it, will they come? If you build it, will they use it? Consider this: you have a consumer that has low flow showerheads, low flush toilets, drip irrigation systems, does this family conserve water? Using a meter monitoring their use, we can answer this, at least for a household in Tucson. Here

Table 4. For a \$1 Million Dollar Primary Impact

Activity	Econ. Impact	Employ	Water Use (Mil Gal)	\$/Gallon
Copper Mining	1.96	11	8237	0.24
Manufacturing	2.15	21	10481	0.21
Electronics	1.7	20	1790	0.95
Grains	2.02	9	20333	0.10
Golf (amusement/Rec Services)	1.54	23	2637	0.58
Electric Utility	1.67	7	2239	0.75
Dairy	2.7	13	12885	0.21
Semiconductors	1.77	13	8452	0.21
Mattresses and Bedsprings	2.28	20	11093	0.21

is some data from Tucson for March (Figure 4). What is important to look at are the irrigation systems. The irrigation system runs for three and a half hours every other morning in March. You do not need three and a half hours of drip irrigation system in Tucson even in March. Having the technology does not mean it is used.

Figure 4. Household Water Meter Trace - Tucson March 2002 (from Woodard 2002)



We also have a problem that everyone is not the same. I find in work that I have done with colleagues at the University of New Mexico that consumers do respond to price, but income, education, and gender are also important. We found in experiments and in data from the city of Albuquerque, people who are male when all else is constant use more water than women. We found that people who are native to Albuquerque all else equal use more water than those who move into the city. We find also that religious attributes are significant. There are significant differences in how people use water based on what they tell us about their religious and political preferences. We also find that the geographic location

in Albuquerque is also important. Temperature or climate fits in there also.

The point of all of this talk is that water pricing is difficult and if you really start to look at what water prices should be, a “one-size-fits-all” policy probably is going to be a very, very difficult thing to use efficiently or effectively. Incorporating consumer heterogeneity, housing sizes, and everything else we’ve touched on into pricing policies is not an easy task. I expect most future-pricing policies will be based on block rate pricing structures. Surcharges are important. I expect the way surcharges are implemented is also going to be important. How quickly price increases are implemented will also be important. If it is a small increase on an annual basis, people tend to absorb it more easily. When it is a large increase, people tend to react differently. Look at gasoline prices. Over the last two years, we have had incremental increases, but what probably got most people’s attention was the fifty to sixty-cent per gallon increase after Hurricane Katrina. The size of the incremental change is probably going to make a difference. Time of use pricing should be considered. If outdoor water is really what we need to go after, should we be charging more not only in the summer, but also for the time of day? Menu pricing should also be considered. You have to consider the fact that not all people’s water uses are created equal. Not everyone has the same ability economically to absorb price increases, and so pricing considerations must include New Mexico’s diverse population and economic means.

The important starting question may not be what the water should cost. Instead the questions may include: how does economic growth impact population growth, and how do economic growth policies coordinate with other policies? If we have economic

growth that requires a high level of education, are education policies in New Mexico also coordinated? How do community development plans fit in? Are we pushing single-family homes? Are we pushing condominium style homes? How does the type of population affect water demand? We do need to know how responsive people are to price. We need to know the economic conditions in the community. We do need to know what type of pricing schedule is going to work best for what type of community. Communities are very different in New Mexico. We have large urban areas and small regional areas that have to be considered. Are the prices necessary for the infrastructure costs economically feasible and politically feasible? If we can answer those questions then we can begin to determine appropriate future water prices.

Thank you.

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