John Stomp, III *was born and raised in Albuquerque and graduated with bachelors and masters degrees in civil engineering from UNM, and is a Registered Professional Engineer in New Mexico (#12015). He was recently appointed Acting General Manager of the Albuquerque Bernalillo County Water Utility Authority. The Water Authority provides water and wastewater services to more than 450,000 residents in the metropolitan area. At this time, John will continue his role as Manager of the Water Resources Programs including water conservation, water resources, groundwater protection and arsenic investigations. His primary responsibility is to implement the City Council adopted Water Resources Management Strategy to provide a safe and sustainable water supply for the City. The strategy includes making the transition from sole reliance on groundwater to renewable surface water supplies, namely, the City's San Juan-Chama water. The project includes the construction of more than $275 million in facilities consisting of a new surface diversion, water treatment plant, and distribution pipelines. He is also responsible for evaluating issues related to compliance with the new drinking water standard for arsenic. John has more than 16 years of experience dealing with water and wastewater issues in New Mexico and throughout the southwestern U.S.*

ALBUQUERQUE WATER REUSE INITIATIVES

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It's good to see so many familiar faces out in the audience today. I think most of us characterize ourselves as the usual suspects at the water conferences. Karl Wood and WRRI have been very generous to the City of Albuquerque in the past by allowing us to share some of the projects we have going on in Albuquerque and I wanted to thank WRRI upfront.

Today I want to talk about the water reuse initiatives in Albuquerque and I'm going to focus on one particular area of concern. When we started to develop reuse, one of our projects was the interface between the City's diversion and the flows in the Rio Grande; specifically, the flows and effects on the Middle Rio Grande Conservancy District.

I think everybody knows that in the 1960s, Albuquerque had a very simple water supply plan: we would pump water from the aquifer, the river would re-supply the aquifer, and we would pay the river back with San Juan-Chama Project water. In the early 1990s, we learned from the USGS that the aquifer is much smaller than we thought and the river was not directly connected with the aquifer. We would never use our San Juan-Chama water because the river

would never leak enough to cause depletion requiring the City of Albuquerque to discharge or release San Juan-Chama water to offset those effects to our return flows.

Everyone has seen the map on Figure 1 over the years but I would like to point out that the map has changed. During the brief time that I've been Albuquerque's water resource manager, we have seen the aquifer change and now there is a cone of depression on the west side. We have always focused heavily on the cone of depression located on the east side of Albuquerque and it covers quite a large area, an area of about 40 sq miles and it has dropped about a 150 ft or so. We have known that the aquifer on the west side was much smaller and much more confined than the east side, and now we are showing the same level of drawdowns and the same effect from our pumping on the west side as we did on the east side.

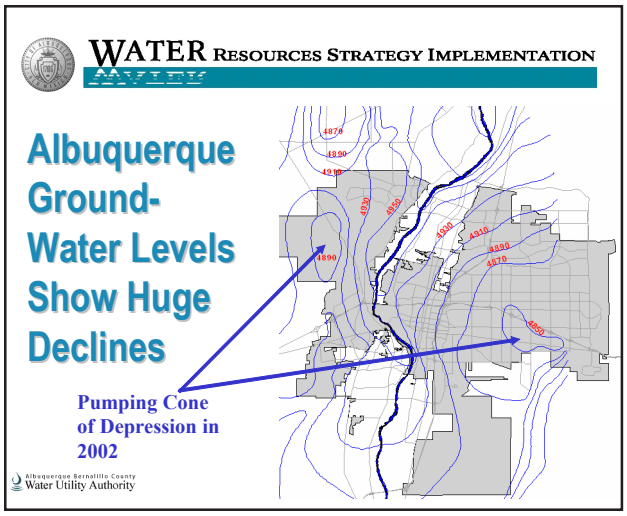

Figure 1.

The USGS developed a groundwater flow model to predict what would happen in Albuquerque if we continue pumping to the year 2060, even while reaching our original 30 percent conservation goal. Figure 2 shows the results of heavy drawdowns and land surface subsidence as predicted on the east and west sides of Albuquerque. I see Larry Webb from the City of Rio Rancho in the audience and I'm sure he doesn't want to hear this, but depletions in the Rio Rancho area are also predicted by the same groundwater flow model. The area encompasses about 90 sq miles of the City of Albuquerque on the east side and the Taylor Ranch area on the west side.

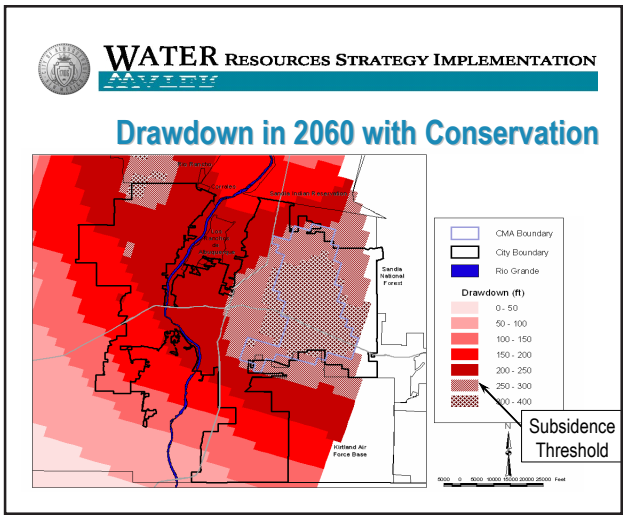

Figure 2.

We are looking at future groundwater depletions and land surface subsidence over the next 40 to 50 years. The USGS published a report last year showing that we are starting to see a response to the City's pumping right now. Figure 3 indicates a small area in purple on the east side of Albuquerque that represents a cone of depression, where we are starting to see the land surface above the pumps respond to our pumping. It has only dropped about 7.5 mm during a peak summer time period and 7.5 mm is hardly measurable, but the point is that we are looking at many years into the future and saying that if we continue to pump, we will have land surface subsidence. It is 60 years down the road and maybe 40 years, but it's not that far away and we are beginning to see that land surface subsidence even now. This is always a bit of surprise to many people.

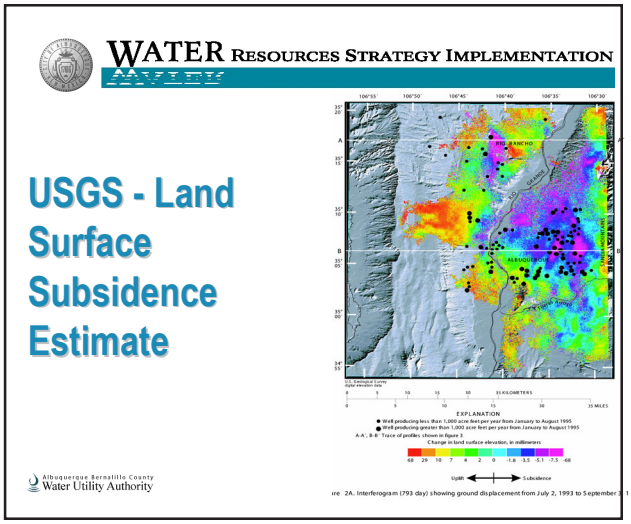

Figure 3.

Our original conservation goal was established in 1995 and our new water goal is to go to a 40 percent conservation reduction goal. The original goal was 30 percent over 10 years and we are in the last year of our 10-year plan. At the end of 2003, we had reached a conservation reduction of about 28%. This year we have pumped 1.2 billion gallons less than we did last year, so we are probably going to be able to say pretty soon that we have met our 30 percent goal, although we know the weather changes frequently and you hate too step out and predict it too quickly. The question now is how we are going to meet our 40 percent goal. We have established a new conservation committee and it will look at what our next steps should be. Everyone is saying that we have already picked the low-hanging fruit, we've done all the easy stuff, and we've had a lot of incentive programs. What will happen when we go to mandatory measures?

Figure 4 is a picture of our water supply plan. The red area is our *Aquifer Drawdown*, the water coming out of storage that causes our drawdowns. Our *Renewable Groundwater* drives some our groundwater hydrologists insane because, after all, "What is renewable groundwater?" We could argue about that sometime, but the key issue now is to show how the City is transitioning away from groundwater for its water supply. We are moving to our San Juan-Chama water, which we are calling *Surface Water We Own*. *Reuse and Recycling* may look like a small slice, but in fact it is not really all that small. If you add together all the large turf areas in Albuquerque in the transition to renewal supply, they account for about 12 percent of our total consumptive use, so it is not such a small piece.

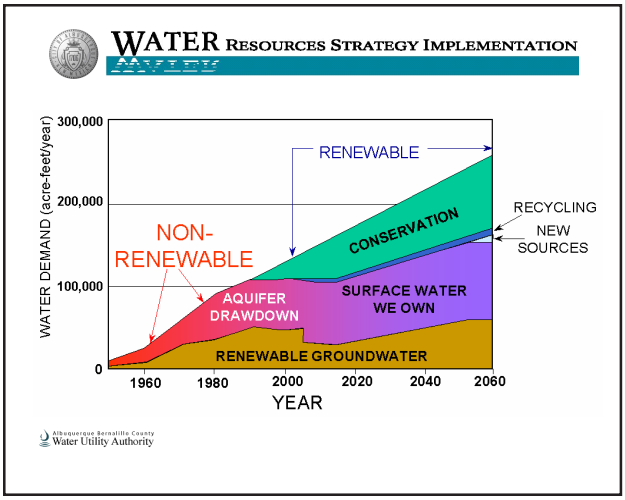

Figure 4.

Most people are aware of our San Juan-Chama Project (Fig. 5). The Reuse Project in the north I-25 area will use a combination of the Colorado River water that we own and industrial reuse water.

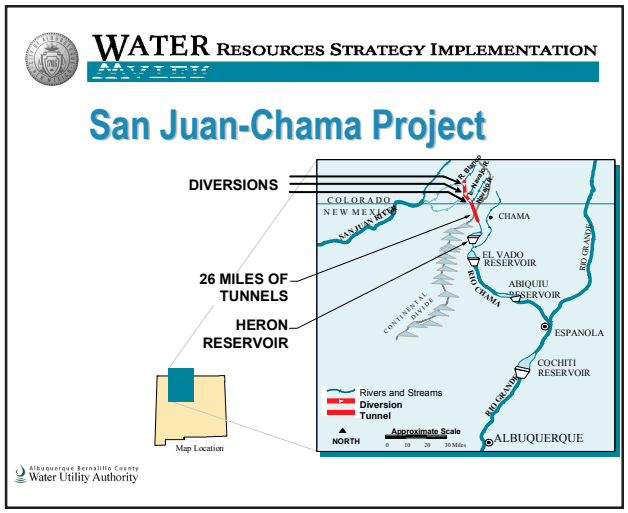

Figure 5.

Our projects to use renewable supplies include: (1) Industrial Water Recycling and Nonpotable Surface Water Reclamation; (2) Southside Water Recycling, and (3) the Drinking Water Project. The first two are reuse and recycling projects while the last one is the big one, the drinking water project, the San Juan Chama Project.

The North I-25 Corridor Reclamation/Reuse Project is an industrial reuse project. In the past, industrial water was purified, used for chip rinsing, and then discharged down the sewer. In 1998, someone came up with the idea of using the discharge water to irrigate Balloon Fiesta Park. The project has been operational since 2000 and now the park is all grass. For a few years, we took effluent from Sumitomo and Philips but since Philips is gone now, we are using discharge from Sumitomo.

The next phase of the project is to take San Juan-Chama water from the river. On Figure 6, the red star locates the diversion that is currently being built. If you have been out to the river at the Alameda Bridge, you can see the reuse facility sitting right on the side of the river. The entire project will cost about $25 million and all infrastructure for the project will be completed by the end of this year. We flipped the switch to begin operation last June and the City of Albuquerque started consumptively using its San Juan-Chama water last year. We were supplementing

industrial reuse last year with some San Juan-Chama water.

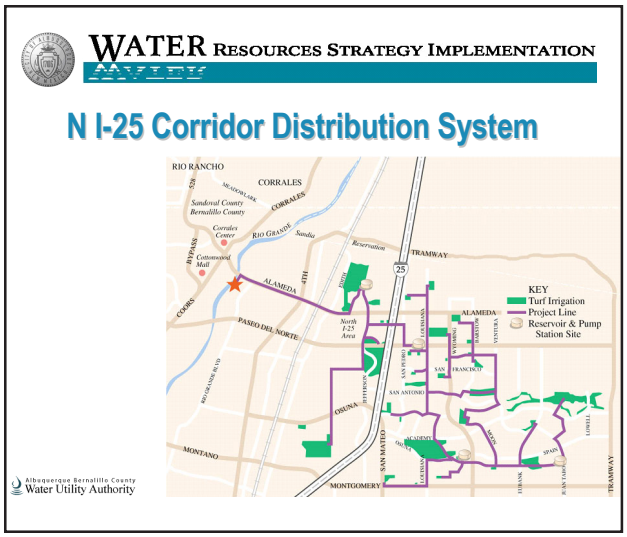

Figure 6.

The primary demand for reuse water is turf irrigation and industrial reuse including cooling towers, concrete production, and fire protection. Total reclaim water demand in the North I-25 Project is about 4,000 acre-feet a year. Originally we hoped to get about 3,000 acre-feet of San Juan-Chama water with about 1,000 acre-feet of reuse water from the industries and combine them to feed all the large turf areas in the Northeast Heights, basically north of Montgomery and in the north valley.

We established water quality standards and have agreements with Philips and Sumitomo on the quality of water they can discharge into the City's system. Because we are applying non-potable water, we had to obtain groundwater discharge permits from the state's Environment Department allowing us to land-apply the industrial reuse water. You would not imagine the regulations and how scared people are of water quality issues. When dealing with Philips, we were asked what would happen if acid were to get into the system. I told them that if Philips discharged acids into the system and it killed all the grass at Balloon Fiesta Park, people would be coming after me, not them. The fact of the matter is that the industrial process was actually separated: Philips and Sumitomo both invested about a million dollars between the two of them to separate completely and isolate their flows so no crossover or changeover could ever occur. The standards developed call for 750 mg/L of TDS so we could keep our ratio at about 4. We had to put limits on fluoride as they use hydrofluosilic acid for chip rinsing.

We are taking non-potable surface water from a new diversion on the river and I'd like to focus on some of the technical aspects of the project because it is a very interesting project in terms of analyzing the effects of the new caisson and new horizontal collector and the diversions we have placed underneath the river just off the Alameda Bridge and the effect on the river as well as on the Middle Rio Grande Conservancy District (MRGCD) facilities. We took borings about every tenth of a mile or so along both sides of the river from Rio Bravo all the way up to Alameda. We analyzed the borings, put together a field investigation and testing plan, drilled a temporary well, conducted testing to begin to characterize the aquifer, determined conductivities, and determined how much water we anticipated getting out of the project from the top 80-100 feet or so. We did additional soils work to characterize the soil and did some sonic borings around the site, specifically around where the caisson was located.

We developed a new groundwater flow model because the USGS model was too big with a grid area about a mile by a mile. I am not going to pretend to be an expert on the model, but it was called the Microsym groundwater flow model. The model looks at the facilities and characteristics in the area like the river and the drain. We developed the model to use as a predictive tool. We used an aquifer test to calibrate the model and used the results of this test to start formulating hydraulic conductivities both horizontal and vertical to try and figure out at what depth to stick the horizontal collectors and how big they should be.

Figures 7 and 8 depict the actual facilities that were built. A radial-collector that the City just built exists where the pump station is now. It is a 30-foot diameter casing that goes down 60 feet. Eight different arms come out of the caisson; only six are shown here, but there are two other arms that stick out underneath the river. South of the radial collector, buried 30 feet into the river, is the horizontal collector that has a well screened. We use the model to predict how much water we will be able to pump. We have a peak demand of about 10 mgd so we have looked at how we can meet that demand. We also used the model to determine the effect of pumping on the Bosque. What is the effect of the drawdown? What about the trees associated with the river around the drain? Would we have impacts outside the river in shallow aquifer home wells located around the facility?

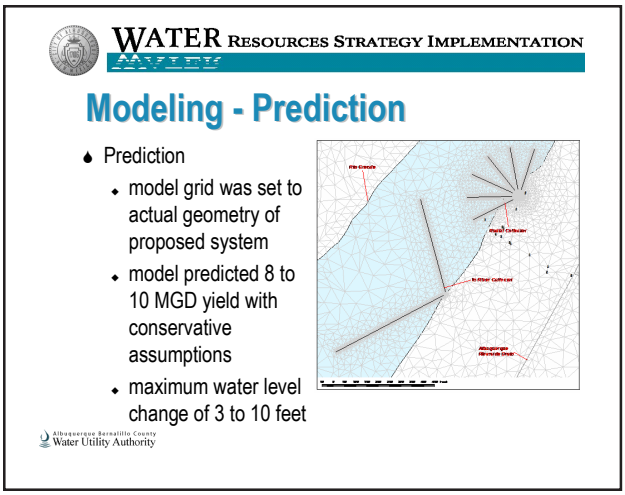

Figure 7.

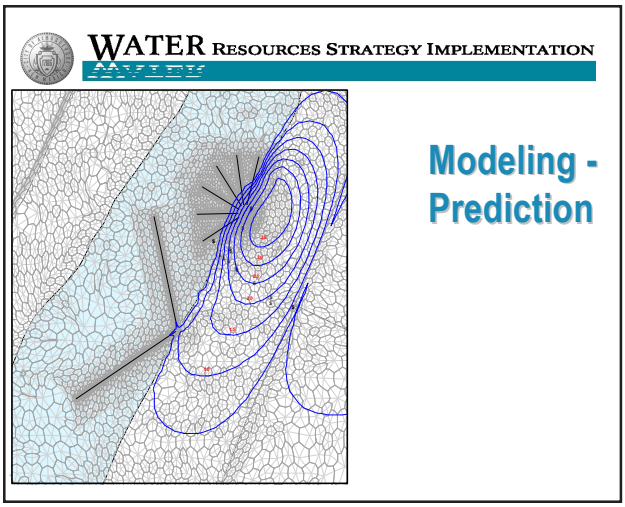

Figure 8.

One of the key issues was to try to develop the percentage and quality of the water coming out of the drain and out of the river. The MRGCD was specifically concerned about this. We modeled the effect of the drain, the facility, how much water would be coming from the drain, and how much water would be coming from the river. I'm happy to report that 90 percent of the water comes from the river and 10 percent comes from the drain, corresponding to the prediction we made when we did the original aquifer test. The scale on the left of Figure 9 is in cubic feet per day (CFD). The graph with percentages shows the same result: 90 percent comes from the river and 10 percent from the drain.

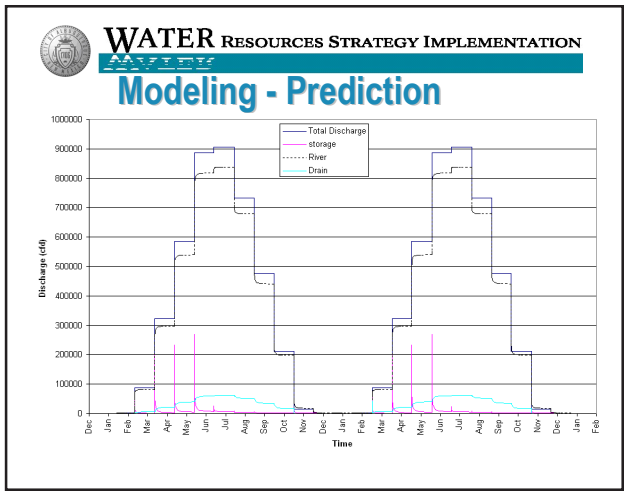

Figure 9.

Figure 10 is a picture of the caisson. The construction was very interesting because we were in groundwater at the time. The construction company, Rainy Collector Wells, came out and drilled in the middle of the winter and had to pour concrete at the bottom in 60 feet of water. We hired a diver who went down into the water, we dropped beams on top of him, and of course he was in the dark. Imagine this guy getting beams from above, placing the beams at the bottom, and then having concrete poured on top of the beams. Like I said, it was a really interesting construction project. We were told by the construction guys, who happened to be from Minnesota, that the water was the coldest they had ever been in.

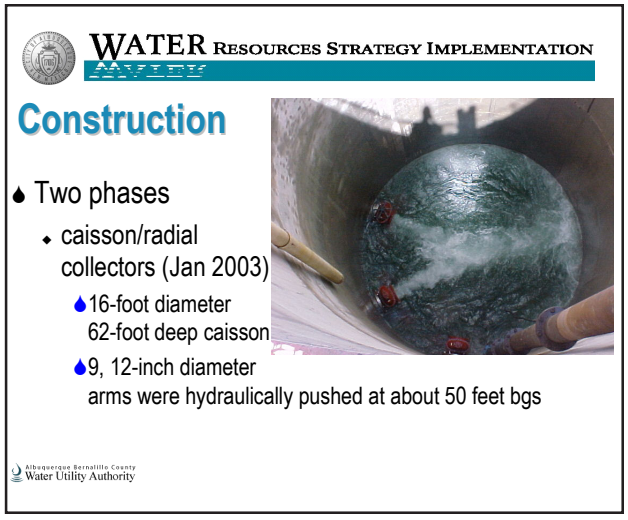

Figure 10.

One of the key issues to talk about is the silvery minnow. While building the San Juan River Project, we crossed the river with 254-inch diameter lines. We

had to build a portable dam in the river to enable us to build half at a time in order to allow the river to flow. Staff from the Department of Fish and Wildlife was out there collecting silvery minnows and other fish that might get stranded once we placed the portable dam. We did the same thing for the horizontal collector arms. In fact, if you were out at the site a few months back, you would have seen the portable dam in the river.

Our original testing of the radial collectors found we could get about 2,500 gallons per minute (gpm) out of the collectors themselves (see Fig. 11). We then tested the horizontal collectors in an effort to make sure we paid the contractor to do what the consultant had designed. We got what we paid for. The final tests indicated we can get about 8,200 gpm from a combination of the radial collector well and the horizontal wells, which is about 10 mgd at peak day. Everything worked out even through there was a lot of sweating along the way.

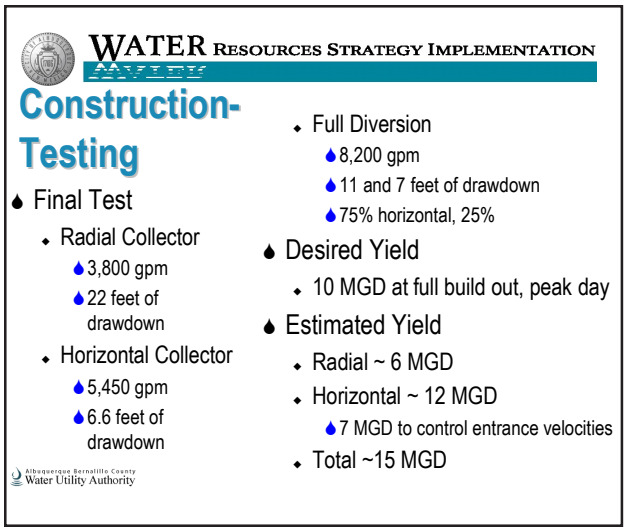

Figure 11.

Some brief construction costs of the caisson include the following. If anyone is interested, I'll be glad to give you individual construction costs.
Combined Costs:

- General - $1.140 M
- Pump Station - $1.95 M
- Radial Collector - $1.5 M
- Horizontal Collector - $1.8 M

Another project we are working on is the reuse project at the Southside Water Reclamation Plant (Figs. 12 and 13). The plant will use effluent from the wastewater treatment plant and will serve all the large turf areas in the Southeast Heights and the South Valley including the Puerto Del Sol Golf Course, UNM Championship Golf Course, Acoposo Power, located on Broadway, Mesa Del Sol, and a whole host of large turf areas and industrial uses.

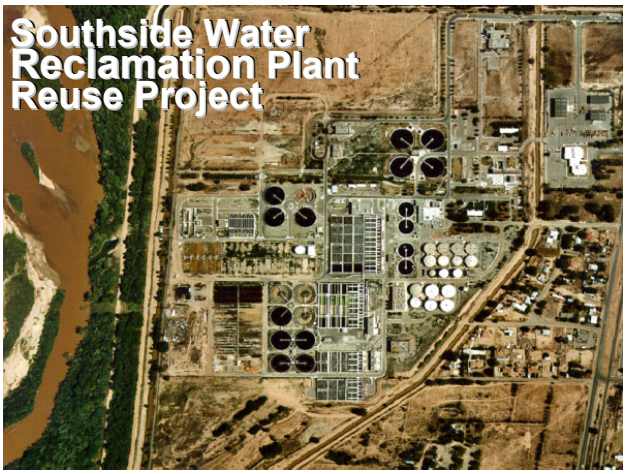

Figure 12.

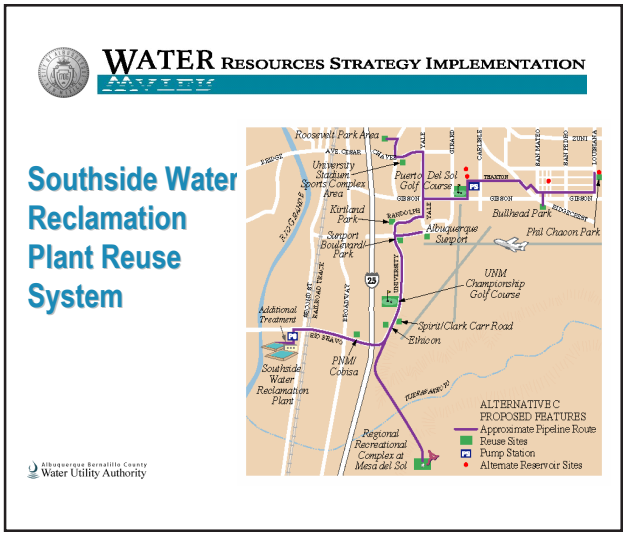

Figure 13.

Before the Environment Department had standards for reuse water, the City developed its own standards. We combined standards from California and Texas to come up with our own standards for the kind of water quality we wanted out of the reuse water. This was a very important effort because as we developed these standards, a lot of economic development opportunities presented themselves to Mesa Del Sol over the years. It has been advantageous from an economic development opportunity standpoint to know how much water is available as well as the

water quality that we can predict coming out of the plant.

Our water quality criteria look like this:

Recommended Albuquerque Reclaimed Water Standards

pH range (S.U.)	BOD (mg/L)	TSS (mg/L)	Turbidity (NTU)	Fecal coliforms (cfu/100ml)	Chlorine Residual (mg/L)
6.0-9.0	5	5	2	Non-detect	1

The criteria are consistent with the Environment Department's regulations that have come out in the last couple of years.

The Project will provide about 5.5 mgd (maximum) or about 2,400 acre-feet of water per year. It is currently under design; we will start construction in December or January, and estimate that it will be complete in about a year. The North I-25 Project will also be completed by next year.

We performed a cost-benefit analysis as required by the Bureau of Reclamation when you utilize Title 16 funding. The Southside WRF Reuse Project will cost $16,000,000 in capital costs and $200,000/year in Operation and Maintenance costs, which comes to $6,700 per acre-foot. We drew the line at about $7,000 per acre-foot. Any large turf area outside this $7,000 per acre-foot was not considered economical, at least at this initial stage. When fully constructed, there will be approximately 35 miles of pipeline ranging in size from 24-inch to 4-inch in diameter and will include four storage reservoirs and five pump stations.

We have one other project in Albuquerque and that is an effort to transition the shallow groundwater use in the Albuquerque core area, the downtown and zoo area, where we have contaminated shallow groundwater. We want to use impaired shallow groundwater for irrigation at the bio-park, the zoo, and some other areas downtown. We will also be cleaning up our shallow groundwater resources in the area. The cost estimate for the project is $2 million. We are looking at combining this water with Fruit Avenue Plume, Superfund cleanup water, to provide a reuse water source for downtown Albuquerque.

Question: I'm Ari Michelson. You gave the $6,700 per acre-foot of water figure. How does this compare with your other water supply options?

Answer: We are purchasing water rights at about $5,000 or $6,000 an acre-foot right now, but that is just the cost of the water right. The $6,700 includes the infrastructure. When we originally did this, we were actually at about $3,500 an acre-foot. If you add this to the $3,500 infrastructure costs, you get the $7,000. The cost would be much higher now since water rights have gone up astronomically over the last few years; it would most likely be about $10,000 an acre-foot right now.

Question: The State Engineer, in approving your diversion project permit, set certain conservation and reuse considerations as conditions of approval. Are you going to be able to meet the State Engineer's requirement in that regard?

Answer: If you haven't seen the City of Albuquerque's Drinking Water Project Department, you should. I believe it will be the wave of the future. The State Engineer has put specific criteria that must be met with a number of significant points in the permit. One such criterion is that the City of Albuquerque attains its 175-gallons per person per day water conservation goal before we are allowed to divert the combination of native and San Juan-Chama water. Before we can take a drop of native water, we must meet the 175-gallons per person per day goal. Of course, there is some ambiguity in terms of how you calculate the 175-gallons per person per day. Everyone in this business knows that you never know the actual population served by your system, so it's kind of a guess. The answer to your question is, yes, in the initial phase. In the second phase, the State Engineer added to the permit approval that the City of Albuquerque reach a 155-gallon per person per day use within 20 years. Our goal is actually more aggressive than this requirement. Everybody understands that water use in New Mexico fluctuates from year to year. It will be very interesting to see what mandatory measures come along between now and the 20-year goal of meeting the155-gallon per person per day. Right now, our conservation plan has been primarily incentive based although we have penalties and fines that will probably change slightly over the next ten years.

Thank you very much.